Archives of
PHYSICAL MEDICINE

Official Journal American Congress of Physical Medicine

(Formerly Archives of Physical Therapy)

EDITORIAL BOARD

EARL C. ELKINS, M.D.
Rochester, Minn.

FREDERIC J. KOTTKE, M.D.
Minneapolis, Minn.

FRED B. MOOR, M.D.
Los Angeles, Calif.

GEORGE M. PIERSOL, M.D.
Philadelphia, Pa.

WALTER M. SOLOMON, M.D.
Cleveland, Ohio

ARTHUR L. WATKINS, M.D.
Boston, Mass.

Copyright, 1951, by The American Congress of Physical Medicine

VOLUME XXXII NOVEMBER, 1951 NO. 11

THE VITAL ULTRAVIOLET BAND

Lies Between 290 and 313 mμ

Radiation in this near ultraviolet portion of the electromagnetic spectrum is rich in antirachitic properties by converting over 50 per cent of ergosterol into the potent antirachitic factor, vitamin D_2.

THE *Burdick*

ULTRA LUX

Ultraviolet Lamp
No. QA-250-N

— with its high vacuum, uviarc pure hot quartz tube containing mercury provides radiation rich in both the germicidal and antirachitic ultraviolet rays.

Thorough investigations have definitely established the *ancillary* therapeutic value of ultraviolet radiation in a great variety of diseases. Ultraviolet irradiation is *specific* for lupus vulgaris and for prevention of rickets by prenatal (entire body) radiation of the mother and nursing mother.

The Burdick Ultra Lux is low-priced, economical in operation and long-lived because of expert construction.

Consult your Burdick dealer or write The Burdick Corporation, Milton, Wisconsin, for complete information.

THE BURDICK CORPORATION
MILTON, WISCONSIN

Contents—Nov. 1951

Volume XXXII No. 11

ARCHIVES OF PHYSICAL MEDICINE
(Formerly Archives of Physical Therapy)
30 North Michigan Avenue, Chicago 2, Illinois

Original contributions, exchanges and books for review should be forwarded to the Editorial Office. All business matters including advertising should be handled through the Executive Office, 30 N. Michigan Ave., Chicago 2, Illinois. The statements in the manuscripts published in the ARCHIVES OF PHYSICAL MEDICINE are made solely on the responsibility of the author. The American Congress of Physical Medicine does not assume any responsibility for statements contained therein. Manuscripts accepted for publication in ARCHIVES OF PHYSICAL MEDICINE are for exclusive publication and may not be published elsewhere.

OFFICERS

American Congress of Physical Medicine

ROBERT L. BENNETT, M.D., Warm Springs, Ga., President.
WALTER M. SOLOMON, M.D., Cleveland, President-Elect.
WILLIAM B. SNOW, M.D., New York, N. Y., First Vice-President.
WILLIAM D. PAUL, M.D., Iowa City, Iowa, Second Vice-President.
HOWARD A. RUSK, M.D., New York, N. Y., Third Vice-President.
GORDON M. MARTIN, M.D., Rochester, Minn., Fourth Vice-President.
A. B. C. KNUDSON, M.D., Washington, D. C., Fifth Vice-President.
FRANCES BAKER, M.D., San Mateo, Calif., Secretary.
FRANK H. KRUSEN, M.D., Rochester, Minn., Treasurer.
WALTER J. ZEITER, M.D., Cleveland, Executive Director.
DOROTHEA C. AUGUSTIN, Chicago, Executive Secretary.

EXECUTIVE COUNCIL

Arthur L. Watkins, M.D., Boston, *Chairman.*
Norman E. Titus, M.D., Downington, Pa., *Secretary.*
William Bierman, M.D., New York, N. Y.
Earl C. Elkins, M.D., Rochester, Minn.
Kristian G. Hansson, M.D., New York, N. Y.
John Severy Hibben, M.D., Pasadena.
Abraham R. Hollender, M.D., Miami Beach, Fla.
O. Leonard Huddleston, M.D., Santa Monica, Calif.
H. Worley Kendell, M.D., Chicago.
Miland E. Knapp, M.D., Minneapolis, Minn.
Disraeli Kobak, M.D., Chicago.
Frank H. Krusen, M.D., Rochester, Minn.
Walter S. McClellan, M.D., Saratoga Springs, N. Y.
Fred B. Moor, M.D., Los Angeles.
Nathan H. Polmer, M.D., New Orleans.
William H. Schmidt, M.D., Philadelphia.
Frederick L. Wahrer, M.D., Marshalltown, Ia.
Robert L. Bennett, M.D., Warm Springs, Ga., Ex-Officio.

EDITOR EMERITUS

Disraeli Kobak, M.D., Chicago.

Subscription — In the United States, its possessions, and Mexico, $7.00 yearly; Canada, $8.00; elsewhere, $14.00 the year.

Advertising rates on application. All advertising copy subject to acceptance by publication committee.

COPYRIGHT: Matter appearing in the ARCHIVES OF PHYSICAL MEDICINE is covered by copyright. Permission will be granted on request for reproduction in reputable publications if proper credit is given. Reproduction for commercial purposes will not be permitted.

Published monthly at Chicago, Illinois, by American Congress of Physical Medicine.

Entered as Second Class Matter, February 15, 1945, at the Post Office at Chicago, Illinois, under the Act of March 8, 1879.

ORIGINAL ARTICLES

New Microwave Diathermy Director for Heating Large Regions of the Human Body. Frank H. Krusen, M. D. 695

Vascular Diseases, Evaluation and Treatment of: With Special Reference to Plethysmography. Arthur E. White, M.D. 699

Observations Regarding Physical Agents in Respiratory Tract Infections. J. Wayne McFarland, M.D., and H. James Hara, M.D. 708

Influence of Physical Agents and of Certain Drugs on Intra-Articular Temperature. Khalil G. Wakim, M.D., Ph.D.; Adrien N. Porter, and Frank H. Krusen, M.D. 714

Post Thoracoplasty Scoliosis. Ralph E. Dwork, M.D.; Harold Dinken, M.D., and Allan Hurst, M.D. 722
Discussed by Dr. Bert A. Treister.

Physical Medicine in Flexion Deformity of the Knee Joint. Louis N. Rudin, M.D., and Daniel J. Cronin 729

•

Editorials 733

•

Medical News 735

•

Book Reviews 738

•

Physical Medicine Abstracts 741

•

EDITOR OF THE MONTH

GEORGE MORRIS PIERSOL, M.D.

Philadelphia, Pa.

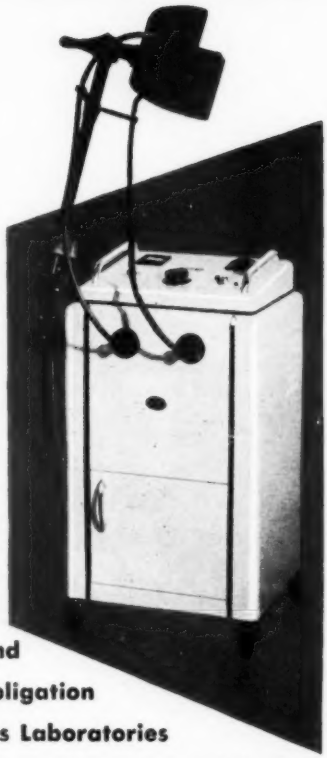
Printed in U.S.A.

DO YOU WANT THE BEST

with economical cost?

APPARATUS FOR PHYSICAL MEDICINE

COMPLETE LINE



MEDITHERM SHORT WAVE

This is the quality line of short wave diathermy. Choice of three F. C. C. approved models of crystal controlled or non-crystal controlled units. The highest in performance at a reasonable price.

MEDIQUARTZ ULTRA-VIOLET

The most complete line of ultra violet generators for the doctor or hospital. Body and localized irradiation, intracavity irradiation and air sterilization.

MEDI-SINE

An electronic low voltage wave generator with all fundamental currents, true "slow sinusoidal", automatic polarity reversal at each alternate impulse. Offers all practical therapeutic wave forms.

For full information — and free trial without obligation — write Dallons Laboratories for the name of your local dealer.

Dallons ENGINEERED

DALLONS LABORATORIES

5066 SANTA MONICA BOULEVARD • LOS ANGELES 27, CALIFORNIA

FUNCTIONAL NERVOUS DISORDERS

IN *Visceroptotic Patients*

Pressure variations induced by movements of the diaphragm are in part responsible for the venous return to the heart. Highly sensitive nervous connections are influenced by its positions. "Globus Hystericus" is seldom manifest in functional visceroptotic patients when reclining. Sudden dropping of the viscera such as occurs upon arising in the morning initiates symptoms. Tension on the diaphragm irritates sympathetic connections, thereby lowering vasmotor tone. "The globus is almost invariably relieved by abdominal support and systematic breathing exercises to release diaphragmatic tension."*

*Gosselin, George A., M.D. *Neurology and Physiology in Functional States* *Connecticut State Medical Journal* *15: 109-113, (February) 1951*

CAMP

Visceroptosis Supports, scientifically designed, universally distributed. Prescribed by physicians and praised by the patients who wear them.

S. H. CAMP and COMPANY, JACKSON, MICHIGAN

World's Largest Manufacturers of Scientific Supports

Offices in New York • Chicago • Windsor, Ontario • London, England

APPROVED SCHOOLS OF PHYSICAL THERAPY **

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Medical Director and Technical Director	Entrance Requirements [1]	Duration of Course	Classes Begin	Maximum Enrolment	Tuition	Certificate, Diploma, Degree
Medical Department — U. S. Army							
(Address all inquiries to the Office of the Surgeon General, Department of the Army, Washington 25, D. C.)							
Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston (San Antonio), Texas	J. E. Tate, Lt. Col., M.C. Agnes P. Snyder, Maj., WMSC	b-e	44 wks.	Oct	20	None	Certificate
Fitzsimons Army Hospital, Denver	H. B. Luscombe, Col., M.C. Olena M. Cole, Maj., WMSC	Affiliated with Medical Field Service School					
Letterman Army Hospital, San Francisco, California	A. E. White, Col. M.C. Emma Harr, Maj., WMSC	Affiliated with the Medical Field Service School					
Walter Reed Army Hospital, Washington, D. C.	J. H. Kuitert, Lt. Col., M.C. Brunetta Kuehlthau, Maj., WMSC	Affiliated with Medical Field Service School					
Nonfederal							
Childrens Hospital, Los Angeles*	S. S. Matthews, M.D. Mrs. Mary J. Dodge	a-b-d	14 mos.	Sept	14	$300	Cert. or Degree
College of Medical Evangelists, Los Angeles*	F. B. Moor, M.D. R. Wm. Berdan	a-b-c	15 mos.	Sept	16	$300	Cert. or Degree
University of Southern California, Los Angeles*	C. L. Lowman, M.D. Charlotte W. Anderson	a-b-d f	14 mos. 4 yrs.	Sept FebSept	16 6	Univer. Univer.	Certificate Cert. & Degree
University of California School of Medicine, San Francisco*	Lucile Eising, M.D. Margery L. Wagner	d	12 mos.	Sept	16	$220[2]	Cert. or Degree
Stanford University, Stanford University, Calif.*	W. H. Northway, M.D. Lucille Daniels	a-d-e f	12 mos. 4 yrs.	Varies Sept	29 16	$690 $220 qr.	Certificate Degree
University of Colorado Medical Center, Denver*	Harold Dinken, M.D. Mary Lawrence	a-b-d	12 mos.	Sept	12	$208[2]	Cert. or Degree
Northwestern University Medical School, Chicago	E. D. W. Hauser, M.D. Gertrude Beard	a-b-d	12 mos.	Oct	16	$450	Certificate
State University of Iowa College of Medicine, Iowa City*	W. D. Paul, M.D. Olive C. Farr	e	12 mos.	Sept	20	$200	Certificate
University of Kansas Medical Center, Kansas City, Kan.*	D. L. Rose, M.D. Ruth G. Monteith	d f	12 mos. 4 yrs.	FebSept FebSept	3 9	$40[2] $40[2]	Certificate Degree
Simmons College, Boston	W. T. Green, M.D. Shirley M. Cogland	a-e f	16 mos. 4½ yrs.	Sept Sept	24	College	Diploma Degree
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	Kenneth Christophe, M.D. Adelaide L. McGarrett	c-d-e-f	1-2-4 yrs.	Sept	30	Univer.	Cert. or Degree
Bouve-Boston School of Physical Education, Medford, Mass.	Howard Moore, M.D. Constance K. Greene	f	4 yrs.	Sept	16	$550	Dipl. & Degree
University of Minnesota, Minneapolis*	F. J. Kottke, M.D. Ruby Green Overmann	c	2 yrs.	Sept	20	$126	Degree
Mayo Clinic, Rochester, Minn.*	E. C. Elkins, M.D. Harry Keown	a-b-c	2 yrs.	Sept	38	$250	Certificate
St. Louis University, Division of Health and Hospital Services, St. Louis*	A. J. Kotkis, M.D. Sister Mary Imelda	f	4 yrs.	JanSept	12	$175	Degree
Washington University School of Medicine, St. Louis*	Sedgwick Mead, M.D. Beatrice F. Schulz	c	2 yrs.	Sept	16	$450 1st yr. $325 2d yr.	Degree
Albany Hospital, Albany, N. Y.	J. W. Ghormley, M.D. Catharine Graham	a-b-d f	12 mos. 4 yrs.	Sept Sept	6	$300 $500	Certificate Degree
Columbia University College of Physicians and Surgeons, New York City*	W. B. Snow, M.D. Floy L. Pinkerton	a-c-e	1-2 yrs.	Sept	50	$680 (1 yr.) $1,200 (2 yrs.)	Cert. or Degree
New York University School of Education, New York City*	G. G. Deaver, M.D. Elizabeth C. Addoms	a (+1 yr. coll.) b-d	12 mos.	Sept	40	$615	Cert. & Degree
Duke University, Durham, N. C.*	L. D. Baker, M.D. Helen Kaiser	a-b-d	15 mos.	Oct	12	$350	Certificate
Cleveland Clinic Hospital, Cleveland*	Walter J. Zeiter, M.D. Mildred Heap	a-b-c	12 mos.	Oct	12	$200	Diploma
D. T. Watson School of Physical Therapy, Leetsdale, Pa.*	Jessie Wright, M.D. Kathryn Kelley	a-b-d	12 mos.	Oct	25	$300	Diploma
Divison of Physical Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia*	G. M. Piersol, M.D. Dorothy E. Baethke	e f	12 mos. 4 yrs.	FebSept Sept	32 40	$300 $600	Certificate Cert. & Degree
University of Texas School of Medicine, Galveston*	G. W. N. Eggers, M.D. Ruby Decker	a-b-d	12 mos.	Jan	8	$149[2]	Cert. or Degree
Hermann Hospital, Houston, Texas*	O. O. Selke, Jr., M.D. Mary Elizabeth Kolb	a-b-d	12 mos.	Oct	15	$300	Certificate
Baruch Center of Physical Medicine and Rehabilitation, Medical College of Virginia, Richmond*	W. J. Lee, M.D. Susanne Hirt	a-b-d f	12 mos. 4 yrs.	Sept Sept	52	$300[2]	Diploma Degree
University of Wisconsin Medical School, Madison*	H. D. Bouman, M.D. Margaret A. Kohli	a-b-d f	12 mos. 4 yrs.	Sept FebSept	22 20	$60 Semes.[2]	Certificate Cert. & Degree

** Reprinted in part J. A. M. A. 146:197 (May 12) 1951.

1. Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Four years of college with science courses; f = High school graduation.

2. Nonresidents charged additional fee.

* Male as well as female students admitted.

aloetherm

newest and finest in
crystal controlled
short wave diathermy

New crystal controlled Aloetherm answers all modern requirements for short wave diathermy. The equipment is efficient and practical in design, rugged, precision construction. It is built exclusively for Aloe to Aloe standards. Full type approval No. D-482 has been awarded the Aloetherm by the Federal Communications Commission. Exceptionally handsome appearance. Available for immediate shipment. Backed by our full two year guarantee. Truly quality equipment yet sold at the lowest price on the market. Write for illustrated literature.

20F7300—Aloetherm Crystal Controlled Short Wave Diathermy complete with Electromagnetic Treatment Drum, Electromagnetic Inductance Cable with Spacers, Flexible Arm, and Line Cord..... **$725.00**

A. S. Aloe COMPANY *Serving the Profession Since 1860*
1831 Olive Street • St. Louis 3, Missouri

GENERAL ELECTRIC

a name your patients know and respect!

INDUCTOTHERM

a name you can depend on

IN every phase of its manufacturing and design, the GE Inductotherm justifies the friendly trust your patients place in its name.

Meets the most exacting clinical approval, too. Brings you the easy means for obtaining the desired quality and intensity of energy indicated for proper treatment. The Inductotherm has the capacity to elevate the temperature in any region of the body to the limit of the patient's tolerance.

See your GE x-ray representative or write X-Ray Dept., General Electric Company, Milwaukee 14, Wisconsin, Rm. O-11.

GENERAL ELECTRIC

NEW MICROWAVE DIATHERMY DIRECTOR FOR HEATING LARGE REGIONS OF THE HUMAN BODY

FRANK H. KRUSEN, M.D.

Section on Physical Medicine and Rehabilitation, Mayo Clinic

ROCHESTER, MINN.

Previous studies have indicated that microwave radiations are effective in heating various regions of the human body for therapeutic purposes.[1-11] There has been a definite need, however, for a director which would distribute the microwave energy over larger regions of the body than is possible with the directors previously available. In an earlier report, my associates and I[1] described three types of directors (director A and director B, which are hemispherical, and director C, which is a corner reflector). These directors cover only relatively small regions of the body.

Now there has been developed for us a director which is clinically very satisfactory for applying deep heating to areas of the body approximately

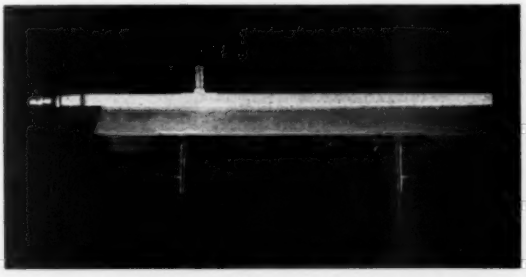


Fig. 1. — A new long director (director U) for application of microwave diathermy. This director when spaced at a distance of 5 inches from the surface of the body will produce satisfactory uniform heating of a large area (approximately 8 by 18 inches in size). The two sliding adjustable all-plastic (lucite) spacers are shown beneath the director.

8 by 18 inches in size. This new director (fig. 1) which has been designated "director U" looks like an elongated corner reflector.

---

1. Krusen, F. H.; Herrick, J. F.; Leden, Ursula, and Wakim, K. G.: Microkymatotherapy: Preliminary Report of Experimental Studies of the Heating Effect of Microwaves ("Radar") in Living Tissues, Proc. Staff Meet., Mayo Clin. **22**:209 (May) 1947.
2. Worden, R. E.; Herrick, J. F.; Wakim, K. G., and Krusen, F. H.: The Heating Effects of Microwaves With and Without Ischemia, Arch. Phys. Med. **29**:751 (Dec.) 1948.
3. Rae, J. W., Jr.; Herrick, J. F.; Wakim, K. G., and Krusen, F. H.: A Comparative Study of the Temperatures Produced by Microwave and Short Wave Diathermy, Arch. Phys. Med. **30**:199 (Apr.) 1949.
4. Gersten, J. W.; Wakim, K. G., and Krusen, F. H.: A Method for Decreasing Reflection of Microwaves by Tissue, Arch. Phys. Med. **31**:281 (May) 1950.
5. Engel, J. P., Herrick, J. F.; Wakim, K. G.; Grindlay, J. H., and Krusen, F. H.: The Effect of Microwaves on Bone and Bone Marrow and on Adjacent Tissues, Arch. Phys. Med. **31**:453 (July) 1950.
6. Gersten, J. W.; Wakim, K. G.; Herrick, J. F., and Krusen, F. H.: The Effect of Microwave Diathermy on the Peripheral Circulation and on Tissue Temperature in Man, Arch. Phys. Med. **30**:7 (Jan.) 1949.
7. Wakim, K. G.; Herrick, J. F.; Martin, G. M., and Krusen, F. H.: Therapeutic Possibilities of Microwaves; Experimental and Clinical Investigation, J. A. M. A. **139**:969, 1949.
8. Martin, G. M.; Rae, J. W., Jr., and Krusen, F. H.: Medical Possibilities of Microwave Diathermy, South M. J. **43**:518 (June) 1950.
9. Rae, J. W., Jr.; Martin, G. M.; Treanor, W. J., and Krusen, F. H.: Clinical Experiences With Microwave Diathermy, Proc. Staff Meet., Mayo Clin. **25**:441 (July) 1950.
10. Royer, R. Q.; Wakim, K. G.; Lovestedt, S. A., and Krusen, F. H.: The Influence of Microwave Diathermy on the Swelling and Trismus Resulting From Odontectomy, Arch. Phys. Med. **31**:557 (Sept.) 1950.
11. Krusen, F. H.: Samuel Hyde Memorial Lecture: Medical Applications of Microwave Diathermy; Laboratory and Clinical Studies, Proc. Roy. Soc. Med. **43**:641 (Aug.) 1950.

The heating pattern, when the director is spaced at a distance of 5 inches from the surface being irradiated, is quite uniform (fig. 2).

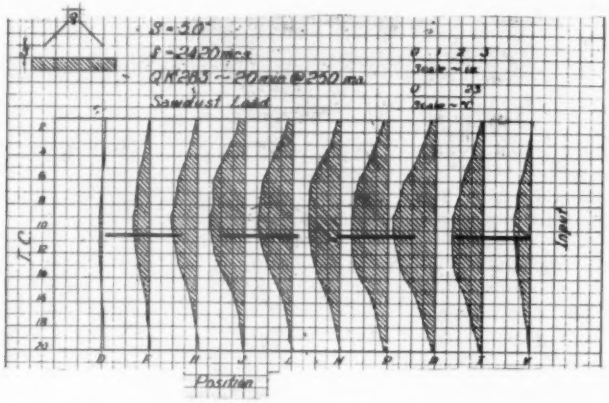


Fig. 2. — The heating pattern produced by director U, at a distance of 5 inches, showing the relatively uniform and diffuse heating produced in an area approximately 8 by 18 inches in size. Key to abbreviations: *S*, spacing; *f*, frequency; *QK283*, type designation of the magnetron tube employed; and *T. C.*, temperature in degrees Centigrade.

Suitable heating can be produced at distances varying from 3 to 7 inches, but optimal and most uniform heating seems usually to occur at a spacing of 5 inches. We have fitted our director U with two sliding and adjustable

Fig. 3. — Method of applying microwave diathermy by means of director U to the posterior surface of a leg. The spacing is 5 inches.

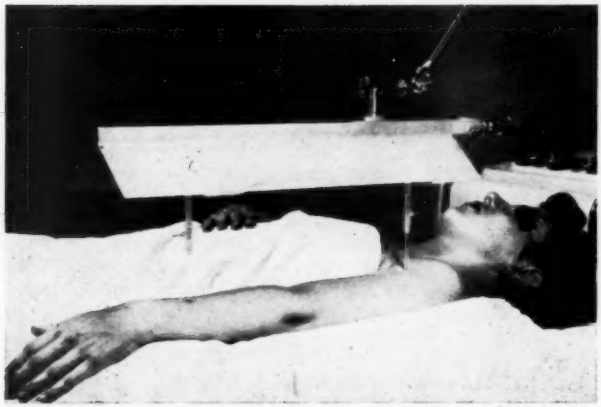


Fig. 4. — Suitable arrangement of director U, at a spacing of 5 inches from the lower edge of the director to the cutaneous surface, for heating the full length of and arm.

Fig. 5. — A satisfactory transverse application of director U for heating the lumbar region. (Spacing, 5 inches. Time of application, twenty to thirty minutes. Dosage, 120 to 150 ma.)

spacers made entirely, including the set screws, of plastic material (lucite). These spacers are graduated in inches and can be adjusted to keep the director in the usual ranges employed most effectively in therapy. These spacers can be seen best in figure 1. The dosage usually should be 120 to 150 ma., 80 to 100 per cent as recorded by the meter indicating per cent of power on the microwave diathermy apparatus.

With this director it is possible to apply heat to one surface of approximately an entire leg (fig. 3) or to the full length of an arm (fig. 4). Furthermore, the director can be positioned longitudinally over the back to irradiate the region overlying essentially the full length of the spinal column. Or, the director can be placed transversely across any region of the trunk to produce heating of a wide area. Thus, if it is placed transversely over the lower portion of the back (fig. 5), it will produce suitable diffuse heating of the lumbar region. Other similar applications will undoubtedly suggest themselves. In order to produce satisfactory heating of the tissues, the usual period of time for each application should be twenty to thirty minutes.

This new large director U, which will produce comparatively uniform heating of an area of the body approximately 8 by 18 inches in size in a period of twenty to thirty minutes at a dosage of 120 to 150 ma., greatly extends the usefulness of microwave diathermy machines. This long director makes it possible to apply microwave diathermy in many conditions which could not be treated so effectively with the smaller directors previously available.

Note. — I am indebted to the Raytheon Manufacturing Company of Waltham, Massachusetts, for the construction of the director and to Mr. Robert Floyd of the Institute of Experimental Medicine of the Mayo Foundation for the construction of the plastic spacers which are described in this article.

VASCULAR DISEASES, EVALUATION AND TREATMENT OF:

With Special Reference to Plethysmography

ARTHUR E. WHITE, B.S., M.D., F.A.C.P.*

Colonel, Medical Corps, U. S. Army

SAN FRANCISCO, CALIFORNIA

Plethysmographs are not new,[1] yet plethysmography as a diagnostic adjunct in peripheral vascular conditions has become generally recognized only within the past decade. This procedure is today where electrocardiography was at the turn of the century.

Until recently, the plethysmograph has been an instrument solely for measuring the change in volume of the part being tested. It is now recognized that there are five distinct types of waves or deflections; that each type has a normal range of volume changes and a normal range of rhythm frequencies. When the volume and frequency deflections do not fall within the normal variations emotional factors or organic pathology exist. It is the interpretation of normal or of variations from the normal that makes the study of the plethysmogram our most accurate objective finding in peripheral vascular evaluation.

Whereas many books are devoted to the interpretation of the electrocardiogram, there are no such ready and comprehensive references available for the interpretation of the plethysmogram. This paper attempts to present sufficient data as recorded by various writers plus my own observations to stimulate interest in this modern diagnostic device in the field of physical medicine.

Prevalence of Vascular Diseases

It is estimated that there are over 7,000,000 persons in the United States disabled by diseases of the heart and arteries.[2] Failure of the cardiovascular system is the most common cause of death in man today and it becomes even more important as the life span increases.[3] Occlusive arterial disease will be the cause of death in approximately 40 per cent of all over forty (40) and if heart disease is added, 60 per cent will have their life terminated in this way. Approximately 20 per cent of this group will lose a part or the whole of an extremity.[4]

Cosin[5] states that arterial insufficiency of the legs in aging and aged persons is an important factor in their lives, but in many cases the family doctor attaches too little significance to this condition, which, in some in-

---

* Chief, Physical Medicine Service, Letterman Army Hospital, San Francisco, California.

† Read at the Twenty-Eighth Annual Session of the American Congress of Physical Medicine, Boston, Mass., August 29, 1950.

1. Johnson, C. A.: The Digital Plethysmograph as a Measure of the Peripheral Circulation, Surg., Gynec. and Obst., 70:31-41 (Jan.) 1940.
2. Rusk, H. A.: The Teaching of Rehabilitation and Physical Medicine. Read before the Congress on Medical Education and Licensure, Amer. Md. Asso., Chicago 9, Feb., 1948.
3. Burch, G., and T. Ray: Cardiovascular System as the Effector Organ in Psychosomatic Phenomena, J. A. M. A., 136:1011 (Apr. 17) 1948.
4. Pratt, G. H.: Surgical Management of Vascular Diseases 1:42, Lea and Febiger, Phila., 1949.
5. Cosin, L. C.: Geriatric Rehabilitation, Geriatrics 3:294 (Sept.-Oct.) 1948.

stances may be more damaging than similar disease of the coronary arteries.

Etiology and Pathology

It has been proved that the thrombosis which causes pulmonary embolism originates in most instances in the veins of the calf.[6-7-8] Pratt[9] feels that the pathologic clotting results from a combination of factors of which three are fundamentally and constantly present. These are (1) an abnormal change in the blood clotting factor in the patient, (2) stasis of the blood-flow, and (3) endothelial irritation or injury. The stasis and endothelial irritation may result from the trauma on the veins from bed rest alone.

The presence of varicose veins is a prominent predisposing cause of thrombophlebitis of the saphenous system.[10] The canalization of the thrombus restores the lumen in the vein but it is narrower than prior to the thrombosis and no longer contains functioning valves at the site of the thrombus.[11]

Bauer[12] has demonstrated valvular incompetence of the femoral and popliteal veins in 55 of 100 consecutive cases of varicosities of the leg. When a patient with incompetent valves in the lower extremities is in the upright position the venous pressure becomes excessively high. This results in edema and diapedesis of the red blood cells; hence the pigmentation so commonly associated with chronic venous stasis.[13]

Ochsner[14] is of the opinion that persistent post-phlebitic edema is caused by persistent vasospasm in the thrombosed vein, increased venous pressure due to valvular incompetence of the deep veins, or extensive perivenous cicatrix.

Arterial spasm frequently results from the irritating inflammatory process within adjacent veins.[15]

Goetz[16] reports a higher incidence of chronic occlusive arterial disease in the lower extremities than in the upper extremities.

Clinical Vascular Physiology

Body functions have been known for many years to be disturbed by emotional stress. Sighing respiration is commonly observed during these periods and is reflected in the cardiovascular system as pronounced vasoconstriction.[4] Chapman and his co-workers[17] pointed out that Hunt in 1899 observed that loss of vagus tone caused an acceleration of heart rate by short-

---

6. Roessle, R.: Ueber die Bedeutung und Entstehung der Wadenvenenthrombosen. (Significance and pathogenesis of thrombosis of veins of leg), Virchows Arch. f. path. Anat. **300**:180, 1937.
7. Neumann, R.: Ursprungszentren und Entwicklungsformen der Bein-Thrombose. (Centers of origin and develoment forms in leg thrombosis), Virchows Arch. f. path. Anat. **301**:708, 1938.
8. Frykholm, R.: Pathogenesis and Mechanical Prophylaxis of Venous Thrombosis, Surg., Gynec. and Obst. **71**:307, 1940.
9. Pratt, G. H.: An Early Sign of Femoral Thrombosis, J. A. M. A. **140**:476 (June 4) 1949.
10. Sullivan, J. M., and Walske, B. R.: Thrombophlebitis, Am. J. Surg. **79**:355 (Mar.) 1950.
11. Edwards, E. A., and J. E.: The Effect of Thrombophlebitis on the Venous Valve, Surg., Gynec. and Obst. **65**:319, 1937.
12. Bauer, G.: The Etiology of Leg Ulcers and Their Treatment by Resection of the Popliteal Vein, J. Internat. Chir. **8**:937 (Sept.Oct.) 1948.
13. Pennoyer, G. P.: The Treatment of Varicose Veins and Ulcers, Ann. Surg. **99**:977, 1934.
14. Ochsner, A.; DeBakey, M., and DeCamp, P. T.: Postphlebitic Syndrome: Treatment by Conservative Measures. Sympathectomy and Other Operative Measures, Surgery **27**:164 (Feb.) 1950.
15. Donaldson, G. A.: Therapy and Prophylaxis of Venous Thrombosis and Pulmonary Embolism, S. Clin. N. Amer. **27**:1037 (Oct.) 1947.
16. Goetz, R. H.: The Rate and Control of Blood-flow Through the Skin of the Lower Extremities, Am. Heart J. **31**:146 (Feb.) 1946.
17. Chapman, E. M.; Kensey, D.; Chapman, W. P., and Smithwick, R. H.: Sympathetic Innervation of the Heart in Man, J. A. M. A. **137**:579 (June 12) 1948.

ening the diastolic period and that Krug and Lindhand, in 1913, concluded that acceleration impulses by the sympathetics caused a shortening of systole as well as diastole.

The minimal metabolic needs of the skin require from 1 to 2 cc. of blood per minute per 100 cc. of tissue. Yet, in the normal subject, during full vascular dilatation the flow may reach 90 cc., whereas, the maximum rate of blood-flow to the extremity as a whole during full dilatation is 25 cc. per minute per 100 cc. of tissue. Thus the arteries supplying the skin have to be practically occluded to harass the nutrition of the skin.

A patient who develops vascular disease but has no initial symptoms, such as intermittent claudication, and who starts off with skin lesions, only, is one whose progress must be viewed with the gravest concern. Frequently the onset of gangrene in elderly persons is the first intimation that they may have trouble with the circulation in the lower extremities.[5]

It is from a deficiency of blood flow through the skin that the danger to the limb arises.[18] Although the blood vessels are not rigid tubes, Poiseuille's law shows that the rate of flow, in rigid tubes, varies with the fourth power of the diameter. Thus an organic occlusion which decreases the lumen by one-half decreases the blood-flow to one-sixteenth of its original volume.

Kramer[19] states that in obliterative endarteritis the oscillometric studies may give satisfactory readings and the pulse may be palpable. This is not surprising, because obliterative endarteritis attacks the smaller vessels, in contrast to thromboangitis obliterans in which the large arterial trunks are involved. The plethysmograph would accurately measure the volumetric excursions in either condition.

In Raynaud's disease the blood-flow between attacks, measured plethysmographically, is not normal, but markedly diminished, because of a high central vasomotor tone.[18] In hypothyroidism and anorexia nervosa, where the metabolism is greatly diminished and heat production minimal, a high central vasomotor tone is found and occasionally Raynaud's phenomenon. In hyperthyroidism and during fever or pregnancy there is an increase in the metabolic rate and an increased cutaneous blood-flow, which can be shown on the plethysmogram.

Plethysmography

The latest edition of one of our leading medical dictionaries defines plethysmography as "the recording of changes in the size of the part as modified by the circulation of the blood in it."[20] Burch's definition[21] is much more comprehensive, and is as follows, "The plethysmogram is a record of the changes in volume, of the part being tested, in relation to time."

The plethysmograph as shown in figure 1 is described in detail by Burch[2] and will not be discussed in this paper.

The extreme sensitivity and operative simplicity of the plethysmograph opens a new approach to the understanding of the more subtle reactions of the cardiovascular system. The accessibility and sensitivity of the vessels

18. Goetz, R. H.: The Diagnosis and Treatment of Vascular Diseases, Brit. J. Surg. 37:146 (Oct.) 1949.
19. Kramer, D. W.: Endarteritis Obliterans, Angiology 1:53 (Feb.) 1950.
20. Dorland: Illustrated Medical Dictionary, 21st ed., 1137, 1948.
21. Burch, G. E.: A New Sensitive Portable Plethysmograph, Am. Heart J. 33:44 (Jan.) 1947.

of the tips of the digits make such an approach practical, quantitative and objective.[3]

The normal resting individual, in a comfortable environment presents

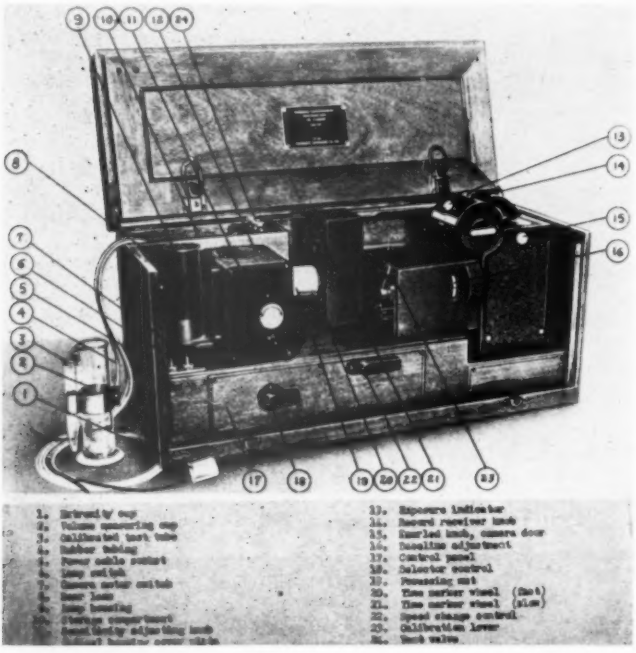


Fig. 1. — The Cambridge Plethysmograph is the instrument referred to throughout this paper. The patients' digit is inserted into an extremity cup which is connected to the instrument by means of a rubber tubing. The entire action is pneumatic.

five types of rhythmic deflections in volume,[21-25] as shown in figure 2. They are (1) pulse deflections, (2) respiratory deflections, (3) alpha deflections, (4) beta deflections and (5) gamma deflections.

The normal pulse deflection per 5 cc. of finger tip is 6.9 cu. mm. and 4.0 cu. mm. per 5 cc. of toe tip.[22-25]

The *PULSE WAVES* represent changes in the digital volume which are primarily influenced by cardiac output, caliber of the arteries and arterioles and tissue distensibility.[24]

The *contour* of the pulse wave is similar to the arterial pulse wave. The dicrotic notch can ordinarily be observed in the plethysmogram of normal

22. Burch, G. E.; Cohn, A. E., and Neumann, C.: A Study of Quantitative Methods of the Spontaneous Variations in Volume of the Finger Tip, Toe Tip and Postero-superior portion of the Pinna of Resting Normal White Adults, Am. J. Physiol. 136:433 (May) 1942.

23. DeBakey, M.E.; Burch, T. Ray, and Ochsner, A.: The "Borrowing-Lending" Hemodynamic Phenomenon (Hemometakinesia) and Its Therapeutic Application in Peripheral Vascular Disturbances, Ann. Surg. 126:850 (Dec.) 1947.

24. Winsor, Travis: Vasomotor Reactions to Heat Among Patients with Arterial Disease, Circulation 1:670 (Apr.) 1950.

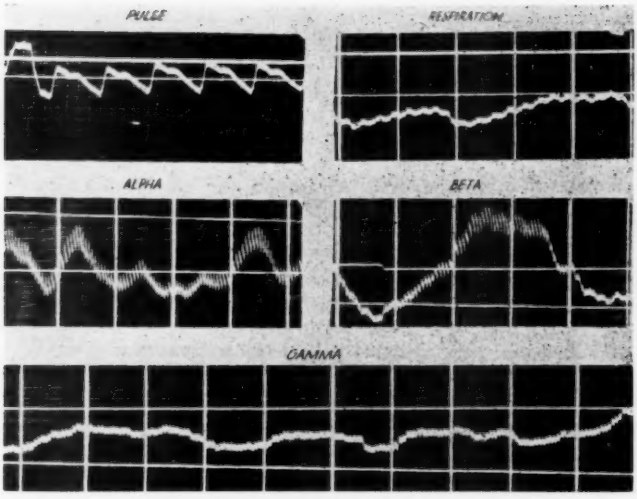


Fig. 2. — Normal Pulse, Respiration, Alpha, Beta and Gamma Waves. The pulse wave tracings were taken at fast speed and the fine vertical lines represent 1/25 second. The other waves were taken at slow speed and the heavy vertical lines indicate an elapsed time of 15 seconds.

resting individuals. This notch becomes more prominent during fever and is less prominent or absent in advanced arterial disease and the peak of the wave becomes rounded.[25] The rebound wave, following the incisura, tends to disappear with increased arterial pressure. This is clearly demonstrated in figure 3.

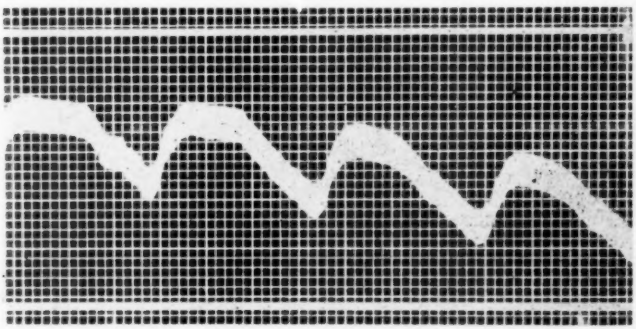


Fig. 3. — Plethysmogram obtained from the tip of the index finger of a hypertensive patient two months prior to a rupture of the middle cerebral artery and subsequent complete left hemiplegia. The dicrotic notch of the pulse wave is less prominent than normal. The rebound wave following the incisura has practically disappeared. These findings are characteristic of hypertension.

25. Dillon, J. B., and Hertzman, A. B.: The Form of the Volume Pulse in the Finger Pad in Health, Arteriosclerosis and Hypertension, Am. Heart J. 21:172 (Feb.) 1941.

This patient was a sixty (60) year old white male with a history of a progressive increase in systolic and diastolic blood pressure over the past six or seven years. At the time of this tracing his blood pressure was 190/110. Two months later the middle cerebral artery ruptured and a complete left hemiplegia resulted.

The *frequency* of the pulse wave coincides with the pulse rate.

The *amplitude* of the pulse wave varies with the sympathetic tone, in the normal individual. The amplitude is reduced if the individual is apprehensive, in pain, or subject to cold environmental temperature and is increased if the person is at ease, drops off to sleep, or is subject to a warm environmental temperature.[1, 24-28]

The administration of nitroglycerine and neostigmine (Prostigmine®) as well as general anesthesia and spinal and peripheral nerve block increase the amplitude of the pulse wave.[24] Tetraethylammonium chloride (Etamon chloride®) administered to patients with peripheral vascular diseases, caused an average temperature rise of 7 degrees F. and a pulse volume increase of 1.3 cu. mm. per 5 cc. of the part. Procaine sympathetic ganglia block resulted in a temperature rise of 13.5 degrees F. and a pulse volume increase of 5.5 cu. mm.[29]

Complete heart block and aortic regurgitation are manifested in the pulse waves of the plethysmogram.[1]

Yamaguchi[30] found that the crest time (time to the peak) was absolutely and relatively proportional to the duration of the pulse cycle in nephrosclerosis, chronic nephritis, arteriosclerosis and hypertension.

The pulse deflections produced by external body heating reach a maximum at temperatures between 103 degrees and 104 degrees F.[31]

In early arterial involvement the skin temperature response to body heating is not impaired but the pulse volume in the plethysmograph tracing is already markedly decreased.[16]

The *RESPIRATION WAVES* represent variations in the digital volume occurring with the normal respiratory cycle.[23-24] The volumes vary from less than 0.1 to 5.0 cu. mm. per 5 cc. of the part[27] and are generally more pronounced in the fingers because of the higher vasomotor tone in the lower extremities.

The respiratory deflections depend primarily upon the variations in the venous return to the heart brought about by respiration. Parallel with increase in venous flow produced by inspiration there occurs a relatively rapid emptying of the venous blood from the part and a resultant decrease in its volume.[23] With expiration the venous flow to the heart is retarded and there is an increase in volume of the part.

Martin and co-workers[32] feel that the magnitude of the respiration waves depends upon the patency of the arteriolar bed, hence the waves will be small or absent in patients with arterial disease.

---

26. Foster, A. D.; Neumann, C., and Rovenstine, E. A.: Peripheral Circulation During Anesthesia. Shock and Hemorrhage: The Digital Plethysmograph as a Clinical Guide, Anesthesiology **6**:246 (May) 1945.
27. Burch, G. E.; Cohn, A. E., and Neumann, C.: Reactivity of Intact Blood Vessels of the Fingers and Toes to Sensory Stimuli in Normal Resting Adults, in Patients with Hypertension, and in Senile Subjects, J. Clin. Investigation **21**:655 (Nov.) 1942.
28. Neumann, C.; Cohn, A. E., and Burch, G. E.: A Study of the Influence of the Character of an Examining Room on the Peripheral Blood Vessels of Normal, Hypertensive and Senile Subjects, J. Clin. Investigation **21**:651, 1942.
29. Massell, T. B.; Adolph, W. E., and French, J. B.: The Use of Tetraethylammonium Chloride as a Vasodilator in Peripheral Vascular Disease: Circulation: 1, No. 4, part 2, 655 (Apr.) 1950.
30. Yamaguchi, T.: Dynamical Studies on the Arterial Pulse Curve, Acta scholae med., univ. imp. in Kioto **12**:21, 1929.
31. Johnson, C. A.; Osborne, S., and Scupham, G. W.: Studies on Peripheral Vascular Phenomena. IV. The Effect of Artificial Fever on the Pulse Volume Changes of the Finger, Am. J. Sc. **190**:485 (Oct.) 1935.
32. Martin, S. J.; Marcellus, F. S., and Sykowski, P.: Plethysmographic Studies with Special Reference to Waves of Respiration, J. Lab. and Clin. Med. **24**:111 (Nov.) 1938.

The *ALPHA WAVES* are under the control of the sympathetic system and have a mean frequency of about eight per minute and a mean volume of about 14 cu. mm. per 5 cc. of finger tip and 7 cu. mm. of 5 cc. of toe tip. They indicate a gross rhythmic change in the vascular bed slower than those produced by the pulse and respiratory deflections. This may be explained by the fact that only a portion of the vascular bed undergoes contraction at one time.[32]

Whereas the volume changes are due essentially to variations in the volume of the blood within the part, McMasters[33-34] and Webb and Nicoll[35] have demonstrated that the contractions of the lymphatics are responsible for much of the flow of lymph. In that the frequency of lymph vessel contractions is approximately the same as the frequency of the alpha waves, an explanation becomes evident.

Alpha waves are of two main types, depending upon the psychological type of the subject — a pattern of consistently large alpha waves occurring in the person of violent temperament and consistently small alpha waves in the phlegmatic one.

The rhythm of the alpha waves is independent of fluctuations in blood pressure but are dependent upon changes in the size of the small vessels,[36-37] which in turn are dependent upon the sympathetic nervous supply. The interruption of the sympathetic pathway results in the disappearance of the alpha waves.[23]

Alpha waves are enlarged through contentment, sleep and mild body heating and reduced through anxiety, chilling, and in patients suffering from arterial disease.

The *BETA WAVES* represent a combination of blood volume, lymph volume, intra and intercellular volume changes.[21] Their frequency varies from thirty seconds to two minutes and volume deflection from 5 to 60 cu. mm. per 5 cc. of part. There is a succession of alpha waves superimposed on the beta wave.

Although the beta waves are the least understood of the five plethysmogram deflections they demonstrate a definite, slow, irregular rhythm, under the influence of the vasomotor tone, which clearly indicates that spontaneous shifts in blood flow are constantly taking place.

Like the alpha and gamma waves the beta deflections are independent of blood pressure and are enlarged with contentment, sleep and mild body heating. They become smaller through anxiety and in patients suffering from arterial disease. Upon complete vasodilatation the beta waves become very small.[24]

The *GAMMA WAVES* also under the influence of the sympathetics, represent relatively slow shifts of large volumes of blood and lymph from one part of the body to another.[24] They range in frequency from one to eight per hour and in volume from 50 to 350 cu. mm. per 5 cc. of part.

A positive gamma deflection is produced by body heating, pooling of blood and lymph, sympathetic block or sympathectomy. It has been observed that a sympathetic block produces a maximum degree of vasodilatation in

---

33. McMasters, P. D.: An Inquiry Into the Structural Conditions Affecting Fluid Transport in the Interstitial Tissue of the Skin, J. Exper. Med. 74:9 (July) 1941.
34. McMasters, P. D.: Conditions in the Skin Influencing Interstitial Fluid Movement, Lymph Formation and Lymph Flow, Ann. New York Acad. Sci. 46:743 (Sept.) 1946.
35. Webb, R. L., and Nicoll, P. A.: Behavior of Lymphatic Vessels in the Living Rat, Anat. Rec. 88:361 (Apr.) 1944.
36. Neumann, C.; Lhamon, W. T., and Cohn, A. E.: A Study of Factors (Emotional) Responsible for Changes in the Pattern of Spontaneous Rhythmic Fluctuations in the Volume of the Vascular Bed of the Finger Tip, J. Investigation 23:1, 1944.
37. Neumann, C.: A Study of the Effect of Spontaneous Variations in Blood Pressure Upon Spontaneous Variations in the Volume of the Finger Tips, Am. J. Physiol. 138:618, 1943.

the part, which cannot be exceeded, thus forming a significant diagnostic test.[38-39] By this means it is easy to determine the amount of increase in vascularity of the part which can be achieved by interruption of the sympathetic pathways.

A negative gamma deflection is noted after prolonged chilling of a part, indicating a slow but definite over-all decrease in the volume of the part.

Treatment

Obviously it is impossible to cover more than an outline of the basic considerations applicable to the treatment of peripheral vascular diseases, in this paper. Likewise, no attempt will be made to list them in the order of their importance. It may be said, however, that rule number one is, no doubt, the fundamental upon which all others rest.

Rules for Treatment:

(1) Conservative treatment should not be carried too far; if administration of Priscoline,[40] tetraethylammonium chloride (Etamon chloride®),[31] other antispasmodic or anticoagulant or if performance of sympathectomy,[14] venous ligation,[41-43] or nerve section[18] is indicated, the earlier it is done the better the chance of saving the limb.

Plethysmography is particularly suited for making this determination. The degree of spasm can be determined and the amount of total circulation can be measured. Oscillometry and skin temperature determinations cannot give this information.

(2) Tobacco should be eliminated.[44]

(3) Alcohol in the form of spiritous liquors, by mouth is useful.[45]

(4) Postural exercises and Buerger-Allen exercises are indicated in uncomplicated cases and contra-indicated in cases of gangrene or impending gangrene.[44-45]

(5) The oscillating bed is beneficial in all stages of peripheral vascular diseases of the lower extremities.[15] Mild heat to the abdomen in conjunction with the oscillating bed is advantageous.

(6) Prophylactic and active skin care should be given.

(7) Intermittent venous occlusive therapy is indicated if the smaller arteries are not compressed.

(8) The limb should be properly bandaged if the patient is ambulatory. If surgery is performed on the thrombosed veins of the saphenous system a snug elastic bandage from the toes to the groin is applied right after the operation and worn seventy-two (72) hours. Early anda ctive ambulation is mandatory the very day of the operation to prevent thromboembolic complications.[46]

(9) Diathermy and other reflex dilatation methods are contra-indicated in a sympathectomized limb, since body heating has no effect on the

---

38. Ochsner, A., and DeBakey, M.: Peripheral Vascular Disease. A Critical Survey of Its Conservative and Radical Treatment, Surg., Gynec. & Obst. **70**:1058 (June) 1940.
39. Ochsner, A., and DeBakey, M.: Peripheral Vascular Disease. Classification and Therapeusis Based Upon Physio-pathologic Alterations, Internat. Clin. **3**:1 (Sept.) 1939.
40. Rogers, M. P.: Use of a Sympatholytic Drug (Priscol), J. A. M. A. **140**:272 (May 21) 1949.
41. Buxton, R. W.; Farris, J. M.; Mayer, C. A., and Coller, F. A.: Surgical Treatment of Long-Standing Deep Phlebitis of the Leg: Preliminary Report, Surgery **15**:749 (May) 1944.
42. Homans, J.: The Late Results of Femoral Thrombophlebitis and Their Treatment, New England J. Med. **235**:249 (Aug. 22) 1946.
43. Linton, R. R., and Hardy, Jr., I. B.: Post-thrombotic Syndrome of the Lower Extremity: Treatment by Interruption of the Superficial Femoral Vein and Ligation and Stripping of the Long and Short Saphenous Veins, Surgery **24**:452 (Sept.) 1948.
44. Farrington, J. D.: Diagnosis and Treatment of Common Peripheral Vascular Diseases of the Lower Extremities, Illinois M. J. **79**:73 (Jan.) 1941.
45. Wright, I. S.: The Treatment of Arteriosclerosis Obliterans, J. A. M. A. **115**:893 ((Sept. 14) 1940.
46. Bauer, G.: Patho-physiology and Treatment of the Lower Leg Stasis Syndrome, Angiology **1**:1 (Feb.) 1950.

sympathectomized part and the blood is shunted to unsympathectomized areas.

(10) Contrast baths are beneficial if properly prescribed and given only in the presence of increased vasomotor tone. If organic pathology is present in the arteries this method of treatment will be of no avail.

General Comments

From the foregoing considerations, it is obvious that the cardio-vascular system is responsive to psychic stimuli, thermal environment, pain, hypertension, fever, pregnancy, hyperthyroidism and hypothyroidism, and kidney, heart and vascular pathology, as well as maintenance of variable rhythmic changes in the volume of the various parts and organs of the body,[3-22-23-47] all of which are not entirely understood at this time.

In the past, these reactions have been followed by relatively limited methods, namely, clinical observation, determination of blood pressure, skin temperature recordings, neurodermometry and sphygmo-oscillometry. The plethysmograph increases our armamentarium.

The peripheral vascular reactions as observed plethysmographically can serve as an objective and quantitative index to certain psychic states and organic cardiovascular pathology.

Summary

Failure of the cardiovascular system is the most common cause of death in man today and it is becoming even more important as the life span increases.

The cardiovascular system is readily accessible for plethysmographic qualitative, quantitative, degree and duration studies. The potentialities for the development of the interpretative diagnostic value of the plethysmogram, in all cardiovascular conditions, are great.

---

47. Hargis, E. H., and Mann, F. C.: A Plethysmographic Study of the Changes in the Volume of the Spleen in the Intact Animal, Am. J. Physiol. 75:180 (Dec.) 1925.

OBSERVATIONS REGARDING PHYSICAL AGENTS IN RESPIRATORY TRACT INFECTIONS *

J. WAYNE McFARLAND, M.D.**
WASHINGTON, D. C.

and

H. JAMES HARA, M.D.***
LOS ANGELES, CALIF.

Within the past few years many good articles have appeared regarding the normal and abnormal physiology of the respiratory tract, adding greatly to our knowledge of what occurs in the individual who succumbs to an acute respiratory infection. They have, in addition, supplied the field of physical medicine with some of the finest evidences we have for the use of physical measures in treating the common cold, pharyngitis, tracheo-bronchitis, and pneumonitis.

To view properly the role physical medicine can play in the treatment of respiratory diseases, let us consider what happens when deviations from the normal occur in nasal physiology, and thus learn which physical agents may help to restore this part of the respiratory tract to a more normal pattern.

The alterations in physiology which occur in the course of a common cold are far from being solved. The play and interplay of the various factors that are known about the genesis of acute coryza are of much interest; reports on investigation of those that are unknown will probably add another score of books, which only helps us realize that disease is a complicated affair even in such an ordinary daily occurrence as the common cold.

The nose is more than a passageway for the entrance of air to the respiratory tract. It has three important functions: (1) it must protect the lungs from extremes of temperature; (2) it must maintain proper moisture or humidity; and (3) it must keep foreign material from entering the lungs. A reflexly controlled blood supply, which opens or narrows the passage to changes of temperature in the inspired air through the erectile tissue in the turbinates of the nose, helps to control and furnish heat to warm the air. It also brings nutrition to the glands that secrete protective mucus, and supplies moisture to the cilia which line most of the respiratory tract.

As one studies this problem, he is convinced that not one of these factors can be left out of consideration without dire consequences as far as normal nasal physiology is concerned. Take for example the work of the ciliated epithelium of the nose, packed as thick as the pile of a carpet. It does a remarkable job of beating a continuous belt of mucus, about eight to twelve beats per second, toward the pharynx. This waving motion carries an endless belt of mucus from nares to pharynx. One constituent of this mucus is lysozyme, which is a bacteriolytic ferment. Abundant in all human tissue, its highest concentrations are to be found in nasal mucus, tears, and saliva.

But there are some physical agents which can disrupt this self-cleansing belt conveyor of mucus, and lay the whole body open to disease. They are extremes of heat and/or lack of moisture. This allows localized drying in the nose, which sets in motion a whole chain of events that produce most

* From ** Department of Physical Medicine, Washington Sanitarium and Hospital, Takoma Park, Maryland, and *** Department of Otolaryngology, School of Medicine, College of Medical Evangelists, Los Angeles, California.

uncomfortable symptoms and eventuates in illness unless prompt measures are instituted. This chain of events that allows a common cold to start has been outlined by Proetz[1] about as follows:

When localized drying occurs in the nose there is failure of humidification. This leads to slowing or complete cessation of ciliary motion, and finally ends in the destruction of the cilia. Nasal mucus then piles up and dries. The results are that all cleansing of the nose stops, and if the dried gelatinous mucus is not removed it produces irritation and forms a medium for bacterial growth. Organisms grow in this locus and eventually penetrate the mucosa. If this inflammation happens to be in the epipharynx area, a drying and burning sensation is experienced by the patient. Should the irritation of dry mucus be near the eustachian tube, there will be sensation of discomfort with itching and burning in that area, and even impaired hearing.

The common denominator then in many of these fall epidemics of colds we believe could be something that produces drying of the nasal mucosa. This is nothing more or less than dry heat and lack of humidity encountered in many homes at this season of the year. And it is to be noted that drying needs to last only a few minutes for cilia to be destroyed, and then no amount of moisture will restore them.

Drying in the nose can be produced by (1) a disability of the mucous glands to secrete mucus, an extremely rare condition; (2) inspired air distributed unevenly by some nasal deformity such as an obstruction, or as a result of removal of important nasal structures by surgery; and (3) the inspiration of excessively dry air. The last named is exceedingly common in American homes, since much of our modern humidification is far from satisfactory. The one physical agent needed here is water, so that the inspired atmosphere will have a relative humidity of at least 45 per cent. Open pans of water are almost better than nothing, but they actually can furnish only a fraction of the moisture that is needed. In many homes the humidity may be as low as 5 to 10 per cent. The nose, as can be seen, is placed at great disadvantage in trying to cope with such a tremendous problem of humidification. In fact, it cannot do it, and its failure to do so is one cause for many winter colds.

Proetz summarizes the problem in two succinct sentences: "A dry nose is at the root of most of the fall epidemics of coughs and colds," and again, "Many a sin has been committed in the name of air conditioning, and the worst offenses are those against drying."

The answer to this problem is education of the public in the necessity of proper home humidification. This is preventive physical medicine in which physiatrists should have a vital interest.

Once acute coryza has developed, certain physical measures can be of real benefit. Certain interesting studies on nasal mucus pH will aid in prescribing proper physical medicine procedures.

Fabricant,[2 2a] studying the pH of nasal secretion, discovered that it fluctuated hour by hour, but that normally it is in the range of 5.5-6.5. He further showed that when a cold begins there is a swing to the alkaline side. As the disease begins to subside the swing again is toward the normal acid pH. Aside from determining that rest, certain nasal medicaments, and emotions all play a role in changing pH of the nose, he showed conclusively that heat or cold also influenced the pH of nasal mucus. When ice bags were

1. Proetz, A. W.: Applied Physiology of the Nose, Second Printing, Annals Publishing Co., St. Louis, Missouri, 1943, p. 272.
2. Fabricant, N. D.: Significance of the pH of Nasal Secretions in Situ, Arch. of Otolaryn. 34:160 (July) 1941. (a) Significance of the pH of Nasal Secretions in Situ; further studies, Arch. of Otolaryn. 34:297 (Aug.) 1941.

applied to both sides of the nose for 20 minutes there was an immediate swing of pH toward the abnormal or alkaline side. On the other hand, when heat was applied to the patient's face by means of an infrared lamp for 15 minutes, there was an immediate swing of the nasal mucus to the normal acid pH.

Here, then, we have a sound physiological basis for applying mild heat to the sinus area when an individual has a beginning acute coryza. If the heat is mild moist heat in the form of steam inhalations, so much the better, for this supplies not only heat but moisture as well, the two vital factors for normal ciliary action and a smooth running mucus belt. In addition, the heat is bringing the mucus secretion back toward its normal acid pH range, at which it is the most active in destroying unfriendly organisms. This heat can be in the form of infrared radiation to the face for periods of 20-30 minutes. Hollender[3] suggests one hour or more, several times daily.

Diathermy produces heat that is even more penetrating, but should be used in cases of acute sinusitis only after a suitable vasoconstrictor has been instilled into the nostrils, otherwise drainage will not occur and actual harm may result. In chronic sinus trouble vasoconstrictors and diathermy daily as an adjunct to other treatment are of value in reducing post nasal discharge.

Should an acute coryza episode involve more than the nose and include also the pharynx, the use of hot saline irrigations to the throat is of value. This leads us to further discussion of the physiology of the nose and throat.

The effects of chilling on the blood supply to the nose and throat has been carefully studied by several investigators. Of the earlier experiments, those of Mudd[4 a-b-c] and his associates are most enlightening. Using a thermopile to record temperatures of the nose and throat, they found that in all cases of chilling of the skin surface there was a reduction of blood supply and a drop in temperature of the oropharynx and soft palate. The skin temperature, when cold wet towels were applied to the backs of their subjects, resulted in a drop of 32.5 degrees to 30 degrees C. (90.5 degrees to 86.0 degrees F.) while the mucosal surfaces fell from 34 degrees to 29 degrees C. (93 degrees to 84 degrees F). The most interesting observation was that the recovery from such ischemia in the mucosa of oropharynx was very slow. Some of their subjects developed typical "common cold" symptoms. The authors mentioned the work of Azzi of Italy which confirmed their results; furthermore this worker showed that "Local applications of cold elicited reflex vasoconstriction in the tonsillar mucous membrane just as more extensive chilling does, although quanitatively somewhat less."

Spiesman and Arnold,[5] carrying out vascular studies of the nose and throat showed the same effect. Their studies lasted over a three year period on twenty-four normal controls and on thirty-nine cold-susceptible individuals. Cutaneous stimulation by heat or cold has a reflex effect on the vasomotor reactions of the nasal mucosa. Their findings on individuals who had frequent head colds are very interesting. Cold applied to the back caused vasoconstriction of the nasal mucosal blood vessels, with a decrease of blood flow and a drop of nasal mucosal temperature. The cold-susceptible individuals responded to this cold application by a lesser drop of nasal temperature

3. Hollender, A. R.: Physical Therapeutic Methods in Otolaryngology, Mosby & Co., St. Louis, Missouri, 1937, p. 442.

4. Mudd, S.; Grant, S. B., and Goldman, A.: Etiology of Acute Inflammations of Nose, Pharynx and Tonsils, Ann. of Otolaryn., Rhinology and Laryng. 30:1 (Mar.) 1921. (Quote Azzi, A.) from La Riforma Medica 37:175, 1921. (a) Reactions of the Nasal Cavity and Post Nasal Space to Chilling of the Body Surface, J. Exper. Med. 34:11 (July) 1921. (b) The Etiology of Acute Inflammations of the Nose, Pharynx and Tonsils, J. Lab. & Clin. Med. 6:175 (Jan.) 1921. (c) Reactions of Nasal Cavity and Post Nasal Space to Chilling of the Body Surface, concurrent study of bacteriology of nose and throat, J. Infect. Dis. 29:151 (Aug.) 1921. (d) Kerr, Wm. J.: The Common Cold and Its Implications, Ann. of Int. Med. 33:333 (Aug.) 1950.

5. Spiesman, I. S., and Arnold, L.: Host Susceptibility to Common Colds, Am. J. Digest. Dis. and Nutr. 4:458 (Sept.) 1937.

than normal individuals as well as a less rapid return to normal nasal temperature.

These investigators determined that emotional stress, anxiety, tension, or grief also upset the vasomotor equilibrium. They were able to reverse this abnormal vasomotor response in individuals who were cold sensitive by having this group take (1) alternate hot and cold showers; (2) refrain from use of high CHO diet; (3) take daily exercise or recreation, and (4) observe adequate hours of rest.

We feel that the inability of the vasomotor mechanism of the body to adjust itself to changes in our physical environment is a frequent component in the common cold syndrome.

We are under the impression that chilling of the body is a frequent factor in allowing respiratory infections to start. In our study of this problem we would like to recite the usual course of events of patients studied by us who were frequent sufferers of head colds. In most of the studies reported thus far on chilling, the subjects have been exposed to chilling effects by applying wet sheets, ice bags, or turning on electric fans to large or small areas of the exposed body.

To determine how much a factor chilling might be in a fully clothed individual who was carrying on a normal daily routine, we cite the following incident. One of us was exposed to an infant suffering from acute coryza. Four days following this exposure, he spent one hour studying in a room which had a continual breeze passing through it. The temperature was 74 F. with a relative humidity of 39 per cent. Although he was fully clothed, a general body sensation of coolness and chilliness was noticeable during the time spent in this room. Within eight hours a severe rhinitis and pharyngitis developed, and twelve hours thereafter both maxillary sinuses were inflamed and laryngitis was severe. Exposure to an organism, then chilling, followed by fulminating acute coryza was the sequence of events.

Chilling of the body and/or sudden temperature changes, followed by acute coryza, is a frequent story among those that are chronic cold sufferers. Kerr[4d] has only recently emphasized this point. This is also the conclusion of Winslow and Herrington[6] after exhaustive studies on temperature and human life. And let it be noted that chilling is not confined to the winter months alone. Summer air conditioning that produces a chill when you walk into the room from the hot exterior is a man-made weather change that may be just as much a shock to a sensitive vasomotor system as any weather change nature produces. Such an experience may be both unpleasant and dangerous. Winslow and Herrington suggest that with a temperature of 95 F. outside, then indoor temperature should not be below 80 F., "while at 90 F. outside, the differential should be only 12 degrees, and at 80 degrees F. outside, only 5 degrees F." This whole subject needs further study.

In those individuals who are frequent sufferers from head colds or who have chronic sinusitis, we have found that nothing is so valuable in building up a normal vasomotor tone as alternate hot and cold sprays. We have followed the program as outlined by Spiesman and Arnold and have found it most helpful. Since systematic sun bathing is another measure which aids in building up general resistance to infection, we add it to the list.

Of the research done in chest diseases, one series of studies is very en-

---

6. Winslow, C. E. A., and Herrington, L. P.: Temperature and Human Life, Princeton University Press, Princeton, New Jersey, 1949, p. 272.

lightening as to the usefulness of physical agents. Holinger,[7] et al., in studying various drugs and their usefulness as expectorants, found by direct visualization of the bronchial tree and by viscosity studies of bronchial secretion that carbon dioxide gas was one of the most effective agents that could be employed in liquefying the sputum. Besides its well-known effect of increasing the rate and depth of respiration, the administration of carbon dioxide hastens the absorption of bronchial secretions. By bronchoscopic visualization these investigators were able to see a marked increase of hyperemia in the bronchial mucosa during the time that carbon dioxide inhalation occurred. Especially was this apparent in the diseased mucosa of those cases suffering from mild or low grade bronchiectasis.

The next best agent which likewise alleviated cough and helped in both absorption and liquefaction of sputum, was steam-inhalation. They (Holinger, et al.) noted that the reaction of hyperemia in the mucosa was less pronounced with steam than with carbon dioxide gas. One of their cases, a boy aged four years, illustrates the effect of carbon dioxide and steam. He had frequent attacks of broncho-pneumonia and asthma. After a long illness, bronchoscopic examination revealed quantities of thick, viscid pus, which could be aspirated but which the patient could not cough up spontaneously. The authors state:

> "First steam and later steam and carbon dioxide inhalations were administered as often as six times a day. Following these administrations he could raise sputum spontaneously during postural drainage. His sputum was definitely thinner. The attacks of cyanosis became fewer in number, and finally there was a decrease in the amount of sputum."

We have found that postural drainage is greatly aided in chronic cases of bronchiectasis by adding frequent inhalations of carbon dioxide by mask, and the use of steam inhalations. With the latter, we supply two important physical agents in the form of moisture and heat.

To study this problem still further and to ascertain why patients under our observation for pneumonias and acute tracheo-bronchitis are frequently benefited by moist heat applied directly to the chest in the form of fomentations, we have launched a study of pH changes in bronchial secretions using various physical agents.

The Bechman pH meter, plus a specially designed electrode which can be passed through the bronchoscope, is used. This allows for direct readings of bronchial secretions in situ. Although our studies have not progressed far enough to justify a detailed report, we have been impressed by the fact that on the application of moist heat to the chest there is drift of pH values to a more acid state. This is similar to what occurs to the nasal secretions when heat is applied. One thing is certain, namely, that physical agents such as heat and cold have a pronounced influence on body chemistry, and especially on the respiratory tract. Undoubtedly other physiological effects of which we now know nothing, also help to account for the benefits derived from the skillful application of physical measures in respiratory diseases.

The physical measures we employ in treating an acute tracheo-bronchitis, with some variations to meet individual needs, are about as follows:

Medicated steam bath (using oil of eucalyptus and/or tincture benzoin) for 10-15 minutes,

---

7. Holinger, P.; Basch, F. P., and Poncher, H. G.: The Influence of Expectorants and Gases on Sputum and the Mucous Membranes of the Tracheobronchial Tree, J. A. M. A. 117:675 (Aug. 30) 1941. Basch, F. P.; Holinger, P., and Poncher, H. G.: Physical and Chemical Properties of Sputum; factors determining variations in portions from different parts of tracheobronchial tree, Am. J. Dis. Child. 62:981 (Nov.) 1941. Physical and Chemical Properties of Sputum; influence of drugs, steam, carbon dioxide and oxygen, Am. J. Dis. Child. 62:1149 (Dec.) 1941.

Followed by alternate hot and cold spray, with percussion douche to lower extremities, finishing with 1-3 minute cold.

The treatment is ended by thorough drying, and the patient's resting for 20-30 minutes.

These procedures are both local and general. Short applications of heat and cold produce a definite increase in metabolism, an increase in the white blood count, a stimulation of the nervous system, and relief of muscular fatigue. These effects may be induced suddenly to enhance the fighting forces of the body. Another effect of these procedures is to overcome the peripheral constriction and vasomotor instability common in the early stages of many respiratory tract infections.

After the disease has become well established, general hydrotherapy should be less strenuous and should aim to enhance resistance and prevent complications. Such procedures as fomentations to the chest, hot foot bath, and cold mitten friction or spray are desirable. If general hydrotherapy procedures are to be used, the patient is best confined to bed.

The acute and subacute bronchitis which commonly accompanies and follows the common cold usually responds better to diathermy than to any other physical measure. The best length of treatment for the adult is about thirty minutes and somewhat less for small children. Fomentations to the chest, although valuable, do not equal diathermy.

For home treatment, the patient is instructed to use steam inhalations ten to fifteen minutes every two hours, and stay in bed. If there are generalized symptoms of headache, myalgia, etc., then a hot half-bath is given twice daily (104-106 F., five to ten minutes) followed by brisk cold friction or cold spray (tap water temperature), one to three minutes. A dry flannel chest pack is worn between treatments.

If pharyngitis is pronounced, then hot saline irrigations to the throat are very beneficial. The use of ultraviolet radiation from the water-cooled quartz lamp or cold quartz lamp following one of the sessions of irrigations, we have found to be of real help in overcoming a sore throat. We have often demonstrated the destruction of germs on the posterior pharyngeal wall by forty to sixty seconds exposures with the water-cooled quartz lamp.

For acute laryngitis we have found steam inhalations and/or hot saline irrigations as effective as any procedure thus tried. A heating compress is often applied to the neck at night, using the body's own heat for continuous warmth.

Summary

We are well aware that we have not covered in its entirety the field of physical medicine in respiratory tract diseases. Such has not been our purpose in this paper. Rather, it has been our hope to bring into clearer focus some of the facts regarding normal and abnormal physiology of the respiratory system that have a direct bearing on the use of physical measures. In so doing, we can give an answer for the how and why of physical therapy on a physiological basis. This, in our opinion, is a most important fact in raising the level of the practice of physical medicine.

We are inclined to believe that selling the virtues of physical medicine to our contemporaries has sometimes been unsuccessful because our approach has been wrong. We have chosen to become enthusiastic over circuits, equipment, wavelenths, and the like, rather than to say we have the following physical therapy procedures which are of definite value for a specific disease. We would not minimize basic research. We are engaged in pH studies ourselves. But clinical application and clinical research are needed.

Conclusions

1. In acute coryza the proper use of warmed humidified air aids in restoring the normal physiological processes of the nose and reduces the sequela and duration of the common cold.
2. Physical measures for complications of the common cold have been listed.
3. In chronic bronchitis, carbon dioxide inhalations and humidified air are of benefit in reducing the cough and tenacious sputum.
4. As preventive measures against respiratory tract infection, physical medicine procedures should be stressed to a far greater extent than they are at present. An active program to educate the public on proper air conditioning would be a forward step in this direction.
5. A program of physical therapeutic measures has been suggested for enhancing the resistance of the cold-susceptible individual.

INFLUENCE OF PHYSICAL AGENTS AND OF CERTAIN DRUGS ON INTRA-ARTICULAR TEMPERATURE *

KHALIL G. WAKIM, M.D., Ph.D.
Section on Physiology
Mayo Clinic
ADRIEN N. PORTER (TECHNICAL ASSISTANT)
and
FRANK H. KRUSEN, M.D.
Section on Physical Medicine and Rehabilitation
Mayo Clinic
ROCHESTER, MINNESOTA

A survey of the literature reveals varied reports on articular temperatures. Lonergan[1] obtained a rise of 1 degree F. in the temperature of the hip joint in dogs on application of long-wave diathermy for a period of one hour. Continuous application of diathermy leading to death of the animal in shock produced a rise of 7 degrees F. in the left hip joint. Lonergan[1] applied long-wave diathermy to the knee joint in man and placed a thermocouple in the popliteal space with the knee acutely flexed on it. After a seventy minute treatment, a rise of temperature of slightly more than 4 degrees F. was observed. By increasing the temperature within the knee joint of dogs and determining the rate of cooling, Kaplan and Joseph[2] reported that the normal circulation rate in articular structures is 0. 75 cc. per minute per cubic centimeter of static fluid.

Sheard and Pratt[3,4] compared the changes of temperatures induced in tissues at the knee joints of dogs with those induced in the muscles of the upper part of the leg by application of short-wave electric fields. They found the

---

* Read at the American Congress of Physical Medicine, Boston, Massachusetts, August 29, 1950.
1. Lonergan, R. C.: An Experimental Study of Diathermy, J. Indust. Hyg. 9:1 (Jan.) 1927.
2. Kaplan, E., and Joseph, N. R.: Determination of Circulation Rate in Articular Structures, Federation Proc. 7:63 (Mar.) 1948.
3. Sheard, Charles and Pratt, C. B.: Changes in Temperatures of Tissues After Systemic Applications of Short Wave Electric Fields, Proc. Soc. Exper. Biol. & Med. 32:763 (Feb.) 1935.

normal intra-articular temperature to be about 2 degrees C. less than the intramuscular temperature. As a result of application of short waves, the rise of temperature in the intra-articular regions was much sharper than in the intramuscular tissue, but the subsequent fall of temperature after treatment was also more rapid. Five minutes after the treatment had been discontinued, the intra-articular temperature attained a fairly constant value which remained approximately 1 degree C. below that attained by the intramuscular temperature. There was a decided increase in the intra-articular temperatures as compared to both rectal and intramuscular temperatures. When considerable air space separates the condenser plates from the surface of the tissues, the change in temperature produced in the deep-lying intra-articular tissues is greater than that produced in the subcutaneous tissues. Sheard and Pratt[3-4] found it possible to produce high temperature in deep intra-articular tissue without the simultaneous production of high subcutaneous temperature.

In their investigation of intra-articular temperatures, Hollander and Horvath[5] noted that following hydrotherapy the joint temperature was only slightly elevated. Application of radiant heat or of paraffin to the surface produced more marked heating of the joint. The greatest elevation of the joint temperature occurred following application of microwave or shortwave diathermy. In another communication, Horvath and Hollander[6] reported that application of hot packs on normal or inflamed joints invariably resulted in depression of the intra-articular temperature of as much as 2.2 degrees F. They found that cold packs raised the joint temperatures and hot or cold packs applied to one knee produced reflex effects in the opposite knee of similar character. They also noted that painful stimuli, apprehension, alarm or smoking lowered the skin temperature and elevated the articular temperature in all cases studied.

In the presence of such varied findings on articular reactions to various physical agents, we decided to study in the trained dog the effects of certain physical agents on the temperature in the treated and contralateral knee joints and to compare the simultaneous effects on the subcutaneous and intramuscular temperatures in the treated area. Furthermore, the effects of intravenous administration of certain well-known vasoconstrictor and vasodilator drugs and of pyrogens were similarly studied.

Five dogs were used in this study. They were trained to lie quietly on a comfortable sponge-rubber pad for the duration of the experiment. Needle thermocouples were introduced aseptically into the shaved and sterilized areas as follows: One needle thermocouple into the intra-articular space of each of the knee joints, one into the muscle, and one into the subcutaneous area, close to the knee joint receiving the physical treatment. These temperatures were recorded potentiometrically. Rectal temperature was recorded by use of a thermistor. After the establishment of control temperatures, a variety of physical therapeutic agents, consisting of hot water bags, ice packs, microwave or short-wave diathermy, or electrical stimulation, were applied singly for a definite period of time. The temperatures were also recorded during application of each of the physical agents used, except during a microwave and short-wave diathermy. After the agent was removed, the temperatures were again recorded at regular intervals until they returned practically to control levels. Ten experiments were performed with each physical thera-

4. Pratt, C. B., and Sheard, Charles: Thermal Changes Produced in Tissues by Local Applications of Radiothermy, Proc. Soc. Exper. Biol. & Med. **32**:766 (Feb.) 1935.
5. Hollander, J. L., and Horvath, S. M.: The Influence of Physical Therapy Procedures in the Intra-articular Temperature of Normal and Arthritic Subjects, Am. J. M. Sc. **218**:543 (Nov.) 1949.
6. Horvath, S. M., and Hollander, J. L.: Intra-articular Temperature as a Measure of Joint Reaction, J. Clin. Investigation **28**:469 (May) 1949.

peutic procedure. The findings were averaged and constructed into curves having the changes in temperature on the ordinate and the duration of the observation in minutes on the abscissa. In order to determine the influence of vasoconstrictors and vasodilators, epinephrine, pitressin, nitroglycerin, histamine and priscoline were each given singly intravenously after temperature controls were established. Repeated temperature recordings were again taken at regular intervals for more than one-half hour after administration of each drug.

Results

The temperature curves in figures 1, 2, 3 and 4 demonstrate, respectively, the effects of hot packs, short waves (cable), short waves (pads) and microwaves on the intra-articular temperatures in both knee joints and on the subcutaneous and intramuscular temperatures in the tissues adjacent to the treated area.

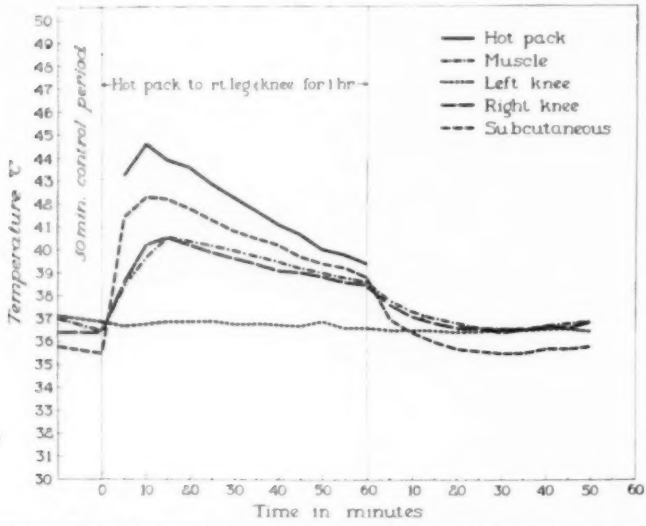


Fig. 1. — Effect of hot pack on intramuscular, intra-articular and subcutaneous temperatures.

When a hot pack was applied to the right leg, including the knee (fig. 1 and table 1), the temperature within that knee joint and its neighboring

TABLE 1. — *Temperatures Recorded in Degrees Centigrade as Controls Before and at the Peak After Application of Physical Agent.*

	Temperature Before and at the Peak After Application of Agent.											
	Treated Knee Joint			Adjacent Muscle			Adjacent Subcutaneous Tissues			Contralateral Untreated Joint		
Agent Used	Before	After	Change	Before	After	Change	Before	After	Change	Before	After	Change
Microwaves	36.4	42.4	+6.0	37.7	40.7	+3.0	35.6	40.5	+4.9	37.1	37.8	+0.7
Short waves (cable)	36.9	39.7	+2.8	38.2	40.6	+2.4	35.5	38.4	+2.9	36.8	37.4	+0.6
Short waves (pads)	37.4	40.7	+3.3	38.5	40.4	+1.9	36.0	40.1	+4.1	37.3	37.8	+0.5
Hot pack	36.4	40.5	+4.1	36.5	40.5	+4.0	35.5	42.3	+6.8	36.9	36.9	0
Ice pack	36.1	17.7	—18.4	37.0	19.6	—17.4	36.2	19.6	—16.6	36.8	36.0	—0.8
Electric stimulation	37.4	37.5	+0.1	38.0	38.5	+0.5	36.3	37.1	+0.8	36.9	37.0	+0.1

tissues rose simultaneously. As seen in the curves (fig. 1) the muscle and right knee had practically identical temperatures throughout the period of application of the hot pack and thereafter. The subcutaneous temperature rose higher than those of the joint and muscle during treatment and became lower after the hot pack was removed. There was slight change in the intra-articular temperature of the left knee during the treatment of the right leg and right knee with hot packs (table 1). Evidently no significant reflex changes occurred in the left knee as a result of heating the right knee and leg, nor is there any evidence or indication of reverse changes in the temperature of the right knee when neighboring structures show a rise in temperature resulting from the physical agent applied.

Similarly figures 2 and 3 and table 1 show the effects of short-wave diathermy on the intra-articular temperature and that of the tissues in the neighborhood of the treated and of the contralateral joint. Even though the control temperature of the treated right knee was about one degree lower than that of the adjacent muscle, immediately after treatment with diathermy the

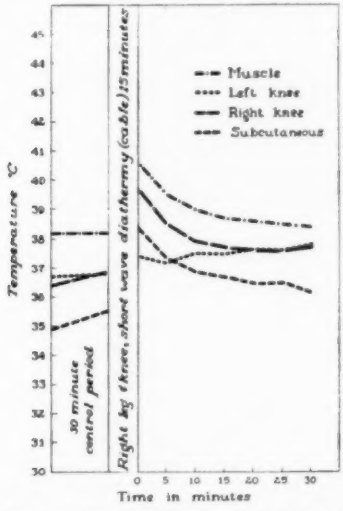


Fig. 2. — Effect of short-wave diathermy (cable) on intramuscular, intra-articular and subcutaneous temperatures.

intra-articular temperature of that knee and that of the muscle had practically the same rise; yet the intra-articular temperature fell at a faster rate than that of the muscle after the diathermy was turned off (fig. 3). There was a slight rise in the temperature of the untreated left knee. However, sufficient heat radiated from the diathermy pads applied to the right knee to account for a direct rather than a reflex rise in the intra-articular temperature of the left knee.

Heating by means of an induction cable wrapped around the right leg and knee produced practically similar temperature rises in the treated knee joint and neighboring tissues (fig. 2). Similarly some rise in the temperature of the untreated left knee joint occurred as a result of direct radiation from

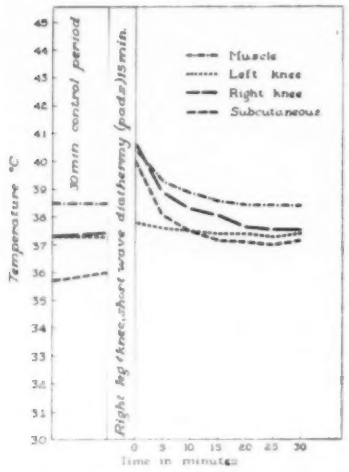


Fig. 3. — Effect of short-wave diathermy (pads) on intramuscular, intra-articular and subcutaneous temperatures.

the cable rather than reflexly. By placing the hand in the field between the cable and the left knee, heat energy could be easily felt emanating from the cable toward the untreated knee. The temperature of the muscles and sub-

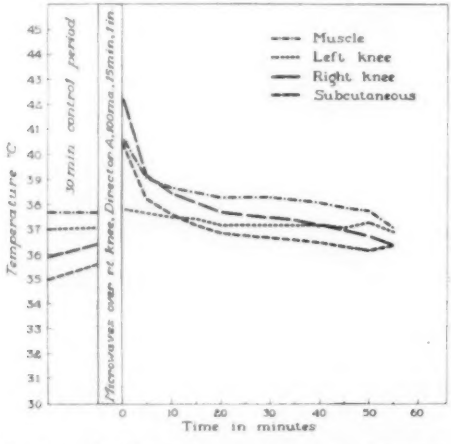


Fig. 4. — Effect of microwaves on intramuscular, intra-articular and subcutaneous temperatures.

cutaneous tissues in the area to which the diathermy cable was applied rose considerably during treatment (fig. 3 and table 1).

The exposure of the right knee to microwaves (100 ma.) for a period of fifteen minutes with the small hemispherical director at a distance of 1

inch (about 2.5 cm.) from the knee surface produced a definite rise in the temperature of the various structures in the treated area. The temperature in the treated right knee joint rose most but cooled at a faster rate than the muscle after the microwaves were turned off (fig. 4). The temperature of the left knee joint rose slightly.

Repeated electrical stimulation of the whole right leg for fifteen minutes at the rate of 10 stimuli per second caused negligible change in intra-articular temperatures (table 1). The average maximal change in the temperature of the stimulated muscles was +0.5 degree C., and in the subcutaneous tissues, +0.8 degree C.

The application of ice packs, at temperatures varying between 6 degrees and 12 degrees C., to the right knee and leg for one hour produced marked reduction of the temperature of the treated right knee joint and the various structures adjacent to it (fig. 5 and table 1). As clearly demonstrated in the curves (fig. 5) the temperature in the left knee joint did not change very

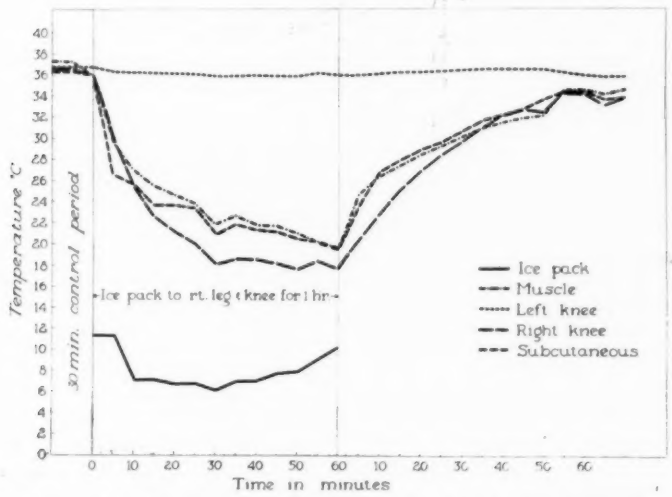


Fig. 5. — Effect of ice pack on intramuscular, intra-articular and subcutaneous temperatures.

significantly; the maximal reduction in the intra-articular temperature of the left knee joint was 0.8 degree C. even though the temperature of the treated right knee was reduced from 36.1 degrees C. to 17.7 degrees C.; namely, —18.4 degrees C. To minimize the direct effect of the ice pack on the left knee, a thick sponge rubber pad was placed between the right and left knees. This definitely demonstrated that, in the absence of direct effect, cooling of the right knee joint and neighboring structures to as low as 16.6 degrees C. by the use of an ice pack did not have any significantly noticeable reflex effect on the temperature in the left knee joint. After the ice pack was removed the temperatures of the treated right knee joint and the various structures in its neighborhood gradually returned toward the control level. However, within one hour after removal of the ice packs the temperatures in the treated area had not completely returned to the control level. None of these physical

agents produced any change in rectal temperature except the induction cable, which raised the rectal temperature 1.1 degree C. over the control.

Of the various known vasoconstrictors and vasodilators, such as epinephrine, pitressin, nitroglycerin, histamine and priscoline, which were admin-

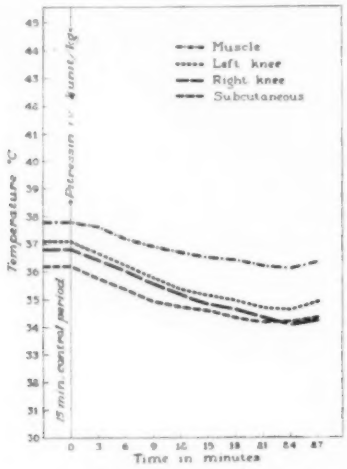


Fig. 6. — Effect of pitressin on intramuscular, intra-articular and subcutaneous temperatures.

istered intravenously, only pitressin had an observable effect on the temperatures in the knee joints, muscles and subcutaneous tissues. Figure 6 demonstrates a gradual but definite reduction in the temperature of these structures after an intravenous injection of 0.25 unit of pitressin per kilogram in the trained dog. As shown in the curves, toward the end of thirty

TABLE 2. — *Effects of Intravenous Administration of Vasoconstrictors, Vasodilators and Pyrogens on the Temperature of the Knee Joints and Other Structures.*

Drug	Dose, I. V.	Number of Experiments	Average Maximal Change in Temperature, °C. Rectal	Right Knee	Left Knee	Muscle	Subcutaneous
Epinephrine	0.01 mg./kg.	10	—0.11	—0.57	—0.43	—0.33	—0.23
Histamine	0.01 mg./kg.	10	+0.17	—0.05	—0.02	—0.15	—0.16
Priscoline	50 mg.	5	—0.20	+0.22	+0.18	—0.20	+0.06
Nitroglycerine	0.65-1 mg.	6	—0.08	—0.12	—0.13	—0.03	—0.25
Typhoid vaccine	0.5-3 cc.	8	+0.28	+0.82	+0.64	+0.21	+0.57
Pyromen	0.5-3 cc.	11	+0.76	+1.44	+1.51	+0.54	+1.25

minutes after administration of pitressin, the temperatures began to return toward the control level. Table 2 shows the average maximal changes in the intra-articular, intramuscular, subcutaneous and rectal temperatures after intravenous administration of specified doses of vasoconstrictors, vasodilators or pyrogens. The effects were not marked; even the pyrogens did not cause a great rise in the temperatures.

Summary

The literature on the effects of physical agents on intra-articular temperature is presented. A study was made of the influence of hot packs, short-

wave diathermy (cable and pads), microwave diathermy, ice packs, percutaneous electric stimulation, vasoconstrictor and vasodilator drugs and pyrogens on intra-articular temperatures and temperatures of adjacent tissues. Hot packs, short-wave and microwave diathermy raised the intra-articular temperature, as well as the temperatures of the adjacent muscles and subcutaneous tissues. No significant reflex changes in the intra-articular temperature of the contralateral joint was observed. Ice packs markedly reduced the intra-articular temperature of the treated knee and adjacent structures, but the reduction in the contralateral untreated knee was slight. Repeated percutaneous electric stimulation produced no significant change in the intra-articular temperature, but the intramuscular and subcutaneous temperatures of the stimulated leg were raised. Intravenous administration of vasoconstrictor and vasodilator drugs (epinephrine, nitroglycerin, priscoline and histamine) produced insignificant changes in the temperature of the joints and adacent tissues. Pitressin produced a gradual but definite reduction in intra-articular as well as in intramuscular and subcutaneous temperatures. Pyrogens produced a slight rise. The changes produced in the intra-articular temperature and in that of neighboring tissues by the physical agents and the vasoconstrictors and vasodilators used in this study were in the same direction.

POST THORACOPLASTY SCOLIOSIS *

RALPH E. DWORK, M.D.**
COLUMBUS, OHIO
HAROLD DINKEN, M.D.***
and
ALLAN HURST, M.D.****
DENVER, COLORADO

Thoracoplasty is a mutilating surgical procedure leaving in its wake a large ugly scar as well as a sunken chest. An important complication is the scoliosis which accompanies this operation. Most thoracic surgeons have accepted these constant accompaniments to thoracoplasty as inevitable and as a small price to pay to achieve a cure of tuberculosis, although the deformed patient may feel otherwise. It would seem that a better understanding of the problem involved and the application of the principles of Physical Medicine early in the post-operative period might serve to at least minimize the deformity of such scoliosis.

The anterior posterior curvature of the spine is universally known. That lateral vertebral asymmetry can occur physiologically is less generally appreciated. This has been variously attributed to right handedness and pressure of the arch of the aorta. A study of cadavers has shown by actual measurement of each lateral aspect of individual vertebra that ten out of seventy vertebral columns showed coronal plane deviation,[1] an incidence of 13 per cent. Wenger and Herman[2] in a study on the influence of the removal of the transverse processes of the vertebrae in the formation of thoracogenic scoliosis found an incidence of 11.7 per cent of preoperative scoliosis. They did not indicate whether this was "pleurogenic"[3] or physiological. While physiological vertebral column asymmetry does occur, it is seldom of such a marked nature as seen in roentgenological or chest work as to be of major importance. However, in evaluating post thoracoplasty scoliosis one has to know the status of the spine before operation.

The three thoracic factors generally considered as contributing to curvature of the spine are rib imbalance, muscle imbalance, and intrathoracic imbalance.[4]

The ribs act as struts in maintaining the architectural symmetry of the spine. Loss of ribs, while it is very likely an important factor, is probably not quite as important a factor as muscle imbalance, from which it cannot wholly be divorced. Removal of the ribs also means removal of influence of the muscles which arise or insert into the removed ribs. Other muscle groups with attachment to transverse processes, also exert influence quite apart from those running to or from the ribs. Muscle imbalance involves,

* Read at the Twenty-Eighth Annual Session of the American Congress of Physical Medicine, Boston, Aug. 31, 1950.
* From the National Jewish Hospital and the University of Colorado School of Medicine, Denver.
** Chief, Division of Tuberculosis, Ohio Department of Health, Columbus, Ohio. Work done while Chief Medical Resident, National Jewish Hospital, Denver, Colo.
*** Professor of Physical Medicine and Rehabilitation, University of Colorado School of Medicine and Hospitals, Denver, Colorado.
**** Formerly Medical Director, The National Jewish Hospital, Denver, Colorado.
1. Miles, M.: Lateral Vertebral Dimensions and Lateral Spinal Curvature, Human Biology **16**:153, 1944.
2. Wenger, H. L., and Herman M.: The Role of the Transverse Process in Thoracogenic Scoliosis, Quart. Bull. Sea View Hospital **7**:45, 1944.
3. Bisgard, J. D.: Deformities of the Chest and Spine Resulting from Thoracic Disease and Operation: Their Prevention, Amer. Jour. Surg. **54**:317, 1941.
4. Bisgard, J. D.: Thoracogenic Scoliosis, Arch. Surg. **29**:417, 1934.

to varying degrees, the following groups — trapezius, rhomboids, serratus anterior, latissimus dorsi, pectoralis and members of the spinae erecti group, namely, ilio costalis, longissimus, levatores costarum, rotators, multifidus, semispinalis and intertransversarii.

Bowing of the spine results from the unopposed action of the muscles which remain intact, unaffected by any operative intervention. Carey[5] dem-

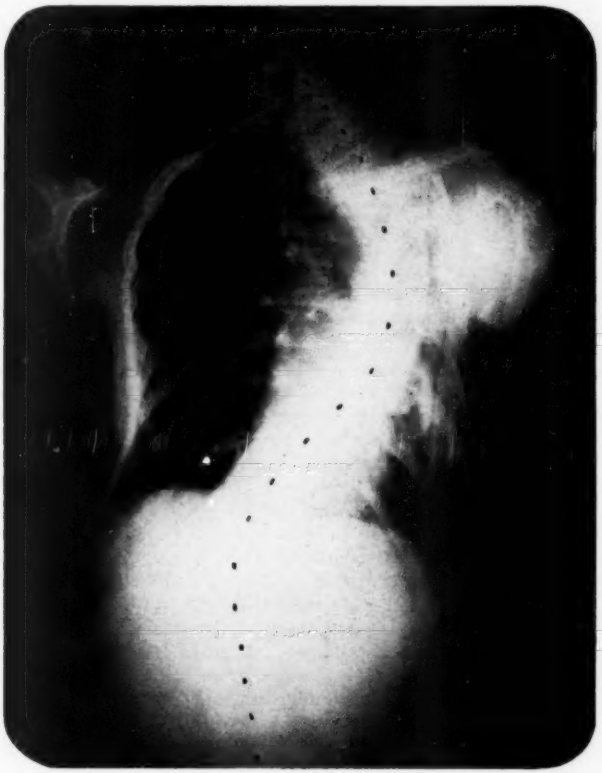


Fig. 1.

onstrated this by a model using rubber bands. The convexity of the curve is always toward the side of the thoracoplasty. The bowing of the spine is only the beginning, however, of a chain of other changes which occur in the skeletal architecture. These changes can be observed roentgenologically. There is increased angulation of the ribs on the same side as the thoracoplasty with separation peripherally. The ribs splay out like spokes on a wheel. On the unoperated side there is reduced angulation and the ribs approximate themselves peripherally.[6] The vertebral bodies in addition to being deviated laterally are also rotated to a varying extent.

5. Carey, E. J.: Scoliosis: Etiology, Pathogenesis and Prevention of Experimental Rotary Lateral Curvature, J. A. M. A. **98**:104, 1932.
6. Kleinberg, D.: Scoliosis, Surg. Gynec. and Obst. **67**:467, 1938.

The tendency to maintain a normal gait, in spite of loss of substance of the chest wall and imbalance following thoracoplasty, results in certain compensatory changes. The shoulder on the same side tends to be elevated. Similarly the pelvic girdle, in an attempt to maintain a right angle with the spine tends to become tilted, so that the contralateral iliac crest becomes prominent. With further compensation this eventually leads to the development of a secondary curve in the lumbar region of the spine. Similarly, tilting of the shoulder would lead to a torticollis-like bending of the head. A compensatory cervical curve develops, which tends to keep the head erect. (Fig. 1.)

The third factor of intrathoracic imbalance is frequently a cause of scoliosis prior to and quite apart from thoracoplasty. This imbalance may be pleural, intrapleural or pulmonary.[4] Empyema, prolonged pneumothorax and fibrosis of old disease are frequently encountered causes in this group, and may exert their influence in either minimizing or accentuating the scoliosis which results from subsequent thoracoplasty.

The splinting of the chest by the intrinsic disease process in lungs and pleura is the initial phase of the problem. Marked pleural thickening with loss of lung function and failure to move the chest wall on inspiration causes paresis of the muscles on that side. Intrathoracic imbalance thus becomes muscular imbalance with scoliosis rapidly developing.

Finally, an important factor in the causation of scoliosis is the removal, by many surgeons, of the transverse processes of the vertebrae at the time of the removal of the ribs. This, as in the removal of the rib, cannot be evaluated without considering the influence of the muscles or ligaments which originate from or insert into the transverse process. Many a cavity which fails to close in a thoracoplasty which did not include the transverse processes is converted upon revision and removal into a successful thoracoplasty. Some surgeons will not consider thoracoplasty revision for a paravertebral gutter cavity if the transverse processes were previously removed. Yet, there are no valid statistics which indicate that the removal of the transverse processes at the time of rib removal gives any better results in curing tuberculosis than leaving them behind.[2]

The revision thoracoplasty consisting of the removal of the bony plate, all rib stumps and transverse processes has been abandoned, for the most part, because of the high mortality and relatively low percentage of cavity closures. Resection of the lobe or lung under the thoracoplasty is rapidly taking the place of the more shocking procedure. Recent experience with plastic substances in extrapleural plombage indicates that, in at least a selected group of cases, thoracoplasty and subsequent scoliosis may be avoided.

In order to evaluate the many factors involved in scoliosis, one hundred cases with thoracoplasty were selected at random from the files of discharged patients of the National Jewish Hospital at Denver. The only criteria for selection were that the charts and X-ray folders be complete. Since it was essential to have at least one preoperative film, patients who came to the National Jewish Hospital with their thoracoplasties were excluded and others added until one hundred cases were reviewed.

The records were reviewed for sex, age at the time of thoracoplasty, occupation, number of ribs removed, number of stages, and whether the transverse processes were also taken. Any associated bone and muscle pathology which may have affected the vertebral architecture was recorded. The degree of scoliosis which developed, when it developed, and the level at which scoliosis was greatest was judged by a review of the X-ray film. A line was

drawn through the center of the maximum number of vertebral bodies prior to thoracoplasty and then similarly through as many of the cervical and lumbar vertebrae as were visible on the film, after thoracoplasty. The scolioses which developed were evaluated by the deviation which occurred from this line. Compensatory curves and the degree of rotation which occurred were evaluated roentgenographically.

Sex and Age. — There were sixty-two males and thirty-eight females. The youngest male at the time of operation was nineteen years, the oldest fifty. The mean age of the males of the group was 31.7 years. The youngest fe-

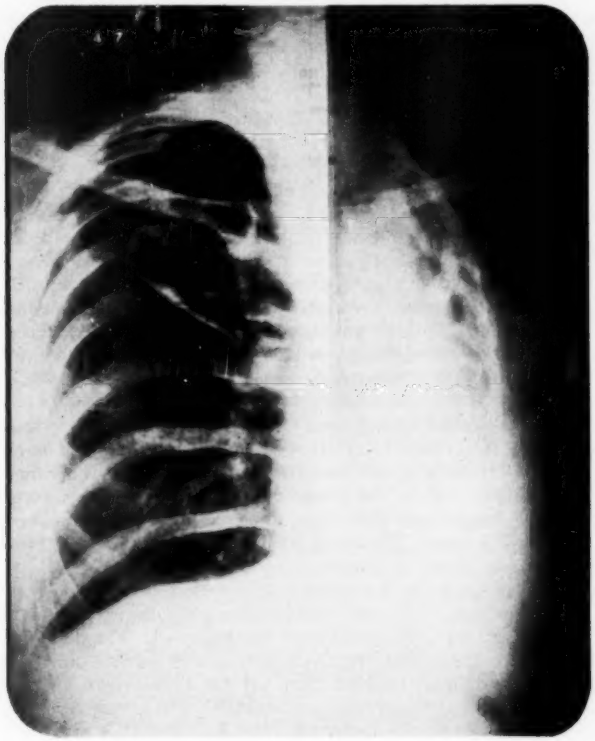


Fig. 2.

male was thirteen years of age, the oldest forty-seven, and the mean age for the females was 30.4 years. There appeared to be no definite relationship between sex and scoliosis. There were four teen-agers in the group, and while scoliosis developed in these it appeared to be no greater than that seen in the group as a whole.

Occupation. — A wide diversity of occupational groups was represented in both sexes. However, there appeared to be a predominance of sedentary occupations in the male group. Only six of the sixty-two had previously been engaged in hard physical labor. Most of the others were office personnel, clerks, salesmen or service personnel. The female group consisted

of housewives or secretarial help for the most part. There appeared to be no relationship between the degree of scoliosis and the type of occupation previously engaged in.

Habitus. — Fourteen males were six feet tall or taller. Only one was five feet tall. Amongst the women there were two who were five feet, none was smaller. There were three who were five feet, eight inches and one who was five feet, ten inches. Weights ranged from 101 to 192 pounds in the males and from 79 to 167 pounds in the females. Tall, thin individuals seemed to show a greater degree of scoliosis than the stouter or the smaller patients.

Side. — In the males there were thirty-two who had their thoracoplasty on the right side, thirty on the left. Amongst the women twenty were right sided operations, eighteen on the left.

Results. — In the entire series there were six cases that did not develop scoliosis and three others in whom it was so slight as to be negligible. Ninety-one cases developed definite scoliosis. Pre-operatively twenty-two cases of scoliosis were noted, usually of but slight degree. Of this number previous lung pathology might have been the cause for the asymmetry in thirteen. In eight cases empyema had existed for varying periods to account for the contracture of the chest, with resulting scoliosis. In nine cases no definite cause was ascertainable and these may fall into the so-called "physiological" group. It is interesting to note that six of these nine were females and were slight, thin individuals.

In those cases in which preoperative scoliosis existed and was due to empyema, if the thoracoplasty was done on the same side as the empyema, the resulting scoliosis did not seem to be as great as when the empyema was on the contralateral side. This was true not only for preoperative scoliosis due to empyema, but for whatever cause. (Fig. 2.)

The sixty-two males had a total of one hundred and sixty-six staged operations. The total number of stages in any one individual varied from one to five, and the total number of ribs removed in any individual varied from two to eleven. In the thirty-eight females there were a total of one hundred and two stages and the total number of stages in any given patient varied from one to four. The total number of ribs removed in any one patient varied from three to eleven.

The degree of scoliosis, the number of vertebra involved in the process and the level at which the lateral curvature reached its maximum deviation were all directly related to the number of ribs removed. The deviation varied from 1¼ inches from the preoperatively determined midline up to 3 inches. The number of vertebrae involved from ten up to nineteen. The level of greatest deviation was usually two, occasionally three, vertebrae higher up than the total number of ribs removed. For example, in a seven rib thoracoplasty, the peak of the curve occurred at the level of the fifth rib.

In general, too, the degree of scoliosis was dependent upon the type of operation performed. There were five cases which had undergone the old Wilms-Sauerbruch type of procedure. Larger posterior stumps remaining behind resulted in less marked scoliosis. Similarly, the presence of posterior stumps of any size led to less deviation than in those in whom the rib was removed in toto. The removal of the transverse process along with the rib head seemed further to accentuate the resulting scoliosis.

The more recent operations were those with little or no stump left behind. Generally, too, the transverse processes of the vertebrae were taken. The general overall result appears to be greater curvature of the spine. Of course, there are occasional unaccountable exceptions to this general finding.

Several patients in whom posterior stumps of ribs were left behind still showed fairly marked scoliosis. In other cases when the ribs were taken completely and the transverse processes of the vertebrae also, the resulting scoliosis, while it did occur, was no greater than in others where posterior stumps and transverse processes were left behind.

In these 100 cases the X-ray follow up which was available varied from two months to thirteen years. An interesting and important point which was elicited by careful study of the films concerned the time of onset of the scoliosis. In nearly every case most of the scoliosis was seen within one month after the final stage. Very frequently films between stages showed well formed lateral curves which only increased on subsequent operation as more ribs were removed and more muscle bundles were transected. The films taken at three months after surgery usually indicated fairly accurately the degree of scoliosis that one could expect. While further bowing of the spine did occur in some cases it seldom increased after one and one-half years after operation. Bisgard believes that scoliosis develops within a few days of rib removal;[4] others believe it takes several weeks. In the films available in this series, X-rays were not taken days after surgery, but in those taken regularly several weeks after operation, scoliosis was present. This is an important factor in the consideration of the preventive measures which might be instituted, and when they should be begun.

Compensatory Curves. — The development of compensatory curves as may be expected takes place somewhat more slowly than does the original scoliosis. In the films available secondary cervical curves were demonstrable in eighty patients. Lumbar curves were demonstrable in only six cases where for one reason or another films of the lower spine had also been taken. Nine cases where films were available had no secondary curves of any kind. These were the same nine that had no scoliosis. There were four in whom no films were available to show either the vertebrae of the neck or the lower lumbar area. It is reasonable to assume that if lumbar films were available for all cases we would be able to see many more lumbar curves. One cannot say, however, how many more, from the material available.

Rotation. — In only three cases did the spinal bodies fail to rotate after thoracoplasty. In all the others, there were varying degrees of vertebral rotation, varying from slight to marked. Most cases showed slight or moderate rather than marked rotation.

Shoulder Elevation. — While most of the cases showed shoulder elevation on the thoracoplasty side varying from ½ to 1½ inches it was completely unpredictable. Many showed no elevation at all, the shoulders remaining level in spite of the scoliosis. There were five cases in which the shoulder on the operated side was actually lower.

Quite apart from impairment of pulmonary function resulting from the lung disease, the thoracoplasty deformity adds to the loss of function, and later to cardiac embarrassment. Pulmonocardiac failure, while it is quite a long time in developing, is the ultimate result.[7] Every effort should be made by the patient, physiatrist, surgeon, and physical therapist to overcome or minimize the deformity.

Physical Treatment. — Physical Medicine has been employed rather widely, in recent years, in an attempt to prevent, minimize or correct the deformity

7. Chapman, E. M.; Dill, D. B., and Graybiel, A.: The Decrease in Functional Capacity of the Lungs and Heart Resulting from Deformities of the Chest. Pulmonocardiac Failure, Medicine **18**:167, 1939.

resulting from thoracoplasty. Many reports[8,9,10] indicate the effectiveness of physical agents and techniques in attaining these objectives. The early institution of treatment is stressed.

Most programs consist of three phases: first, preoperative orientation of the patient as to the nature of the surgical procedure and its possible sequelae and instruction in proper bed positioning and early mobilizing exercises to be performed post-operatively; second, treatment post-operatively, between stages, in an attempt to improve bed posture and later sitting posture, mobilize the shoulder girdle and begin early abdominal exercise routines and diaphragmatic breathing; later, standing and early ambulation with good alignment is stressed. Postural wedge-compression of the thorax, by having the patient lie on wedge pillows or sandbags on the operative side, is widely used. Following completion of the final stage of resection, a graduated program of treatment is instituted, aimed at taking the patient from the bed through the various phases of convalescence to total rehabilitation. The recent use of "resistive exercise" [10] is most interesting, but further observation is needed before final evaluation of its place in treatment is made.

It is fairly obvious, from the literature, that such an approach is highly desirable and effective in preventing noticeable postural abnormalities, "frozen," painful shoulders, deconditioning and other sequelae. It has not, however, been adequately demonstrated by long range, objective studies that conservative treatment by physical means alone is effective in preventing the development of structural scoliosis, which occurs so frequently following extensive thoracoplasty. It is hoped that further studies will shed additional light on this important subject.

Summary

The basic mechanisms in the production of post-thoracoplasty scoliosis were presented. An analysis of a hundred cases of thoracoplasty was made in terms of post-operative scoliosis. The role of physical treatment in preventing, minimizing or correcting scoliosis was briefly indicated and the need for further objective studies in this field was noted.

Discussion

Dr. Bert A. Treister (Cleveland, Ohio): The authors of this interesting and timely paper have presented in detail an analysis of the several factors which are of importance in the development of scoliosis. Thoracoplasty, which they have very aptly described as a mutilating surgical procedure, is perhaps one of the most frequent causes of severe scoliosis. The psychic trauma to the thoracoplasty patient with severe spinal deformity is obvious. The adverse physiological effects to the respiratory system are difficult to evaluate.

Personal experience with thoracoplasty patients for the past few years has demonstrated that spinal deformity can be definitely minimized with preventive postural training. That this can be accomplished is indeed remarkable when one considers the many important musculosketal attachments that are distributed or destroyed by such radical operation. Preventive measures aim to maintain level shoulders, which facilitate the fitting and wearing of clothing and give the patient as normal an outward appearance as possible.

Unless preventive measures are instituted, postural deformity starts to develop after the first stage of thoracoplasty. Therefore, as pointed out by the authors, postural treatment must be instituted early. Preoperative orientation helps materially.

The method which I have found to be successful in preventing or minimizing scoliosis involves certain corrective postural attitudes assumed by the patient when lying and when standing. Such procedures do not necessitate exertion on the part of the patient in a condition where rest is such an important part of the general treatment.

I have had no experience with the other types of treatment, but there must be some common factor which prevents deformity,

8. Treister, B. A.: The Prevention of Postural Deformity After Thoracoplasty, Arch. Phys. Med. 39:446 (July) 1949.
9. Huddleston, O. L.: Reconditioning for Tuberculosis Patients, Arch. Phys. Med. 28:575 (Sept.) 1947.
10. Progress Report — Chest Surgery and "Resistive" Exercise, Arch. Phys. Med. 31:408 (June) 1950.

such as compensatory curves as produced by nature, provided the structures post-operatively are kept mobile.

An interesting observation in thoracoplasty patients is the lack of correlation between the deformity as revealed by X-ray and the external appearance of the patient. In a small group of thoracoplasty patients with good posture, X-rays of the thoracic spine with the patients standing revealed varying degrees of scoliosis, some rather severe. This lack of correlation is fortunate since, as pointed out by the authors, practically all thoracoplasty patients show X-ray evidence of scoliosis.

PHYSICAL MEDICINE IN FLEXION DEFORMITY OF THE KNEE JOINT *

LOUIS N. RUDIN, M.D.

Chief, Physical Medicine Rehabilitation Service

and

DANIEL J. CRONIN

Supervisor, Orthopedic Brace Shop

Veterans Administration Hospital, Fort Howard (Baltimore), Maryland

Many patients are referred to Physical Medicine for the correction of flexion deformity of the knee joint. This is a serious functional disability which is preventable in most cases. When bilateral, it confines the patient to a wheel chair existence. When unilateral, the patient is able to ambulate only with the aid of crutches, using a swing through gait, which requires more than average development and strength in the muscles of the upper extremities and shoulder girdles.

Causes

Pain. — Flexion deformity of the knee is mainly a result of attempts to escape pain. The most comfortable position for a painful knee, whether the pain is due to inflammation or trauma, is a semiflexed position. A position of complete extension and complete flexion intensifies the pain. The patient tries to preserve this semiflexed position at all costs. Often he is helped by misinformed, solicitous nurses and ward attendants, who put a pillow under the knee to make the patient as comfortable as possible.

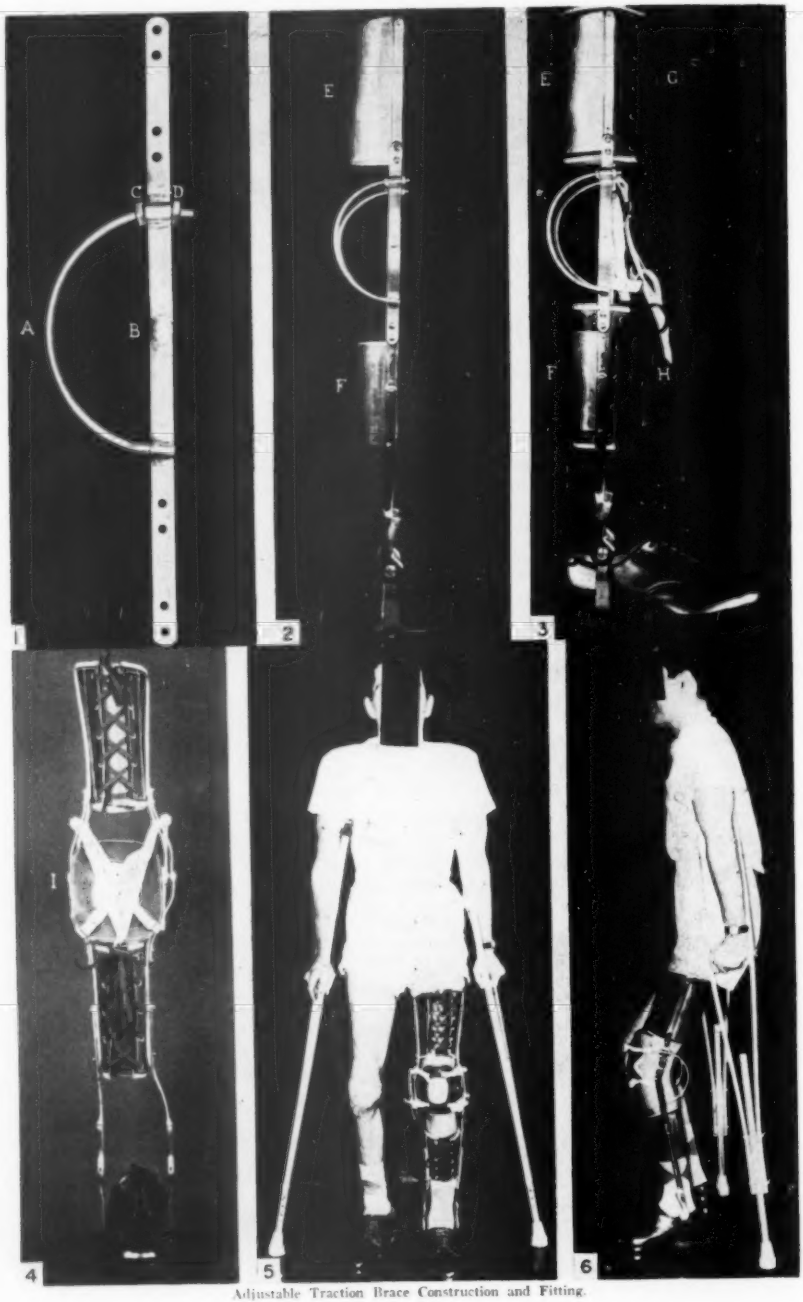
Muscle Spasm. — This is present in all inflamed joints. It is nature's method of splinting, and, as always, the flexors, in this case the hamstrings, outpull the extensors — the quadriceps. When the inflammation has subsided, after a lapse of time, the hamstrings have shortened and a flexion contracture exists.

Quadriceps Atrophy. — Quadriceps atrophy sets in very rapidly in cases of fracture of the femur or tibia or arthritic manifestations in the knee joint. The exact cause of this atrophy is not known. It is more than just the ordinary disuse atrophy. As a result of quadriceps atrophy and weakness, an imbalance occurs, with flexion deformity of the knee as a result.

Effusion in the Knee Joint. — The knee joint has the greatest capacity in

* Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors.

The authors wish to express thanks to the Medical Illustration Section (Mr. Robert E. David, Chief, Medical Illustration Section and Mrs. Jeanette M. Whitehorn, Medical Artist), Veterans Administration Hospital, Fort Howard, Maryland, for the preparation of the illustrations.



Adjustable Traction Brace Construction and Fitting.

the semiflexed position, hence effusion may be a factor in contracture of the knee joint.

Treatment

Prevention. — An explanation must be made to the patient with a disability around or of the knee that flexion contracture is a possible serious complication. He must cooperate and not keep the knee in flexion and not put pillows under the knee. In some patients a posterior splint may be required to insure that the knee is kept in extension. The nurses and ward attendants must be instructed against making the patient comfortable by any means which cause constant flexion of the knee.

Physical Therapy. — Once contracture has developed, physical medicine management will consist of:

1. Heat — whirlpool baths, at temperature of 103 to 105 degrees F. It is preferable to immerse the patient up to the waist in the leg whirlpool. Active underwater exercises should be done by the patient.

2. Electrical stimulation of the quadriceps. This is best done with the surging faradic current, for 15 minutes, two or three times daily. Sinusoidal current (direct, surging, interrupted, with alternate polarity), 350 cycles per second, about 18 to 20 surges per minute may also be used.

3. Muscle setting exercises to the quadriceps, starting with 15 to 20 contractions every hour and increasing to tolerance.

4. Active, assistive motion to the knee joint, and passive stretching of the contracted hamstrings, manually, and through weights. In severe cases, in spite of judicious efforts, only a slight increase in extension will be accomplished and a traction apparatus not fixed to the bed must be used.

Treatment by Traction Apparatus

Standard Plaster Cast with Turnbuckles. — This has the following disadvantages:

1. It adds insult to injury, by further immobilization of partially stiff joints and atrophied contracted muscles.

2. It prevents access to the patient's parts for the carrying out of physical therapy procedures.

3. Pressure sores develop frequently, because of alteration of the shape and alignment of the cast when the turnbuckles are tightened.

Special Traction Brace. — To facilitate the overcoming of contractures by passive stretching, a special brace was developed by Mr. Daniel J. Cronin, which has the following characteristics:

It consists of (fig. 1): a curved threaded rod, A; a metal hinge, B; a threaded nut, C, in contact with the upper arm; a lock nut, D. To operate this mechanism, the threaded nut, C, is moved along the curved rod, A, to change the angle of the hinge, B.

This mechanism (a Forrester hinge), shown in figure 1, is riveted to a long leg brace with knee action, with metal cuffs, E and F, which are wider than usual, as shown in figure 2. This facilitates the distribution of force on the lower extremity.

Leather cuffs, G and H, with laces, are attached opposite the metal cuffs, E and F (figure 3). An adjustable leather knee cap, I (figure 4), with straps is fixed to the brace over the knee. It is better to make the straps longer, allowing a wider range of adjustment. The excess may be trimmed away any time, after proper fitting. The knee cap prevents possible slight telescoping of the knee when force is exerted from behind, through advancing the nut on the curved rod. The brace in use is shown in figures 5 and 6. The advantages of this brace are:

1. A graduated, uniform force is provided by advancing the nuts on the curved rod to overcome contractures of the hamstrings.

2. The brace may be taken off to provide access for physical therapy procedures.

3. One mechanism may be used for many patients, as it is detachable from the brace.

4. The patient can bathe and is able to use crutches for ambulation if contracture is unilateral.

5. The only parts in contact with the patient's lower extremity are the wide metal and leather cuffs. These are adjustable and thus prevent pressure sores.

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIAL .·.

PHYSICAL MEDICINE AND PSYCHIATRY *

The scope of Physical Medicine as a specialty involves practically every organ in a human being, including an organ referred to as "mind" or "psyche," the function of which is "to adjust the total organism to the needs or demands of the environment." [1] Physical medicine and psychiatry have much in common: both approach the individual as a unit, follow him throughout his illness and plan his readjustment in the community (this might be referred to as a *"strategic"* rehabilitation approach). The utilization of psychiatric concepts enhances the value of physical medicine in the administration of definitive therapy (*"tactical"* rehabilitation). Psychiatry can help us understand the reactions of the patients, which are strongly influenced by personality factors.

Overholser calls attention to other common ground between psychiatry and physical medicine. He states, "both are new specialties, and both arose under conditions which occasionally savored of charlatanry, with the result that certain suspicions still linger in the minds of some segments of the public . . . today, however, both have achieved standing and general acceptance as important specialties, built on a sound foundation of investigation and scientific study. . . ." [2] Nevertheless many physiatrists are still distrustful of psychiatric practices.

In the training programs of future specialists in physical medicine, intensive clinical work is devoted to the major fields of orthopedics, surgery, neurology and other fields of medicine. But no such work is being done in reference to psychiatry. Many potential physiatrists have never seen the inside of a mental hospital. And yet, here are some statistics: In the United States, in 1950, there were 705,423 beds for patients suffering from mental and nervous diseases with an average census of 675,096 patients and 308,000 yearly admissions![3] Statistics are not available of all the mentally ill *outside* the hospitals. Physical Medicine has a great deal to offer these patients. Those in psychiatric hospitals, trying to utilize physical medicine techniques, have looked for guidance to the specialists in physiatrics, but that guidance has not been forthcoming. Many of the basic principles of Simon Baruch, Kellogg, and Rebekah Wright are still sound but need much augmentation and streamlining.

Physiatrists have shown little interest in research possibilities of this wide field. Some contributions have been recently made[4] but the volume is

---

* (Based upon a paper by the same title, by Jack Meislin, M.D., Chief, Physical Medicine Rehabilitation Service, Franklin Delano Roosevelt, V. A. Hospital, Montrose, N. Y.; read at the meeting of the Eastern Section of the American Congress of Physical Medicine at Philadelphia in April, 1951.)

Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion of the Veterans Administration.

1. Hinsie, L., and Shatzky, J.: Psychiatric Dictionary, Oxford University Press, N. Y., 1949.
2. Overholser, W.: Physical Medicine and Psychiatry, some interrelationships, J. A. M. A. **138**:1221 (Dec. 25) 1948.
3. Hospital Service in the United States, J. A. M. A. **143**:25 (May 6) 1950.
4. Watkins, A. L., and others: Psychiatric and Physiologic Studies on Fatigue, Arch. Phys. Med. **28**:199 (Apr.) 1947.

insignificant. Textbooks on physical medicine offer a meager ration when it comes to the management of the mentally ill.

It is evident that psychiatry can offer a great deal to the physiatrist. Understanding of the irritated — and irritating — behavior of some of his patients would permit the physician to enter the situation more objectively and so minimize his own anxiety reactions. There is also a large area of psychosomatic syndromes which every physician must be aware of in order to avoid prolonged ineffective treatment. In many instances the proper psychological approach *combined with* physical measures may bring about a satisfactory solution.

Some chronic diseases display certain patterns directly attributable to personality problems. One of these is rheumatoid arthritis. Other psychological considerations are of importance in patients suffering from neurologic pathologies and in medically handicapped children. Still other stubborn cases are those who wish to "escape into illness." Unless one is aware of these factors the situation might result in the blind leading the blind.

The physiatrist must be on the lookout for evidence of mental disturbance due to physical measures such as may result from bodily contact between the therapist and the patient. He must also recognize other dangerous mental symptoms in his patients when timely psychiatric treatment is of greatest urgency.

Too often concentration on symptoms overshadows the total problem. To fulfill the role of a physician one must become "the therapist of the person, no longer merely the therapist of a disease."[5] Here the therapist-patient relationship plays an important role.[6,7,8] It has also been shown how this relationship may be significant in the actual treatment of a local condition.[9]

In conclusion we should like to quote Cannon,[10] whose ideas on this subject expressed over a third of a century ago are almost as applicable today as they were then:

> "Although physicians have not infrequent occasions to observe instances of functional disturbance due to emotional causes, there is an inclination to minimize or to slight that influence, or even to deny that it is a part of a physician's service to his patient to concern himself with such troubles. Let the patient go to the clergyman for comfort and consolation and for the resolution of his deep anxieties. . . . So triumphantly and so generally have the structural alterations which accompany altered functions been demonstrated under the microscope, that any state which has no distinct 'pathology' appears to be unreal or of minor significance. Fears, worries and states of rage and resentment leave no clear traces in the brain. What then, have physicians to do with them? . . . If physicians show this indifference, however, is it surprising that men and women beset by emotional stresses, turn from them and go for help to faith healers and to others who recognize the reality of these disturbing states?"

A significant step was taken at the recent Denver meeting when members of the American Congress of Physical Medicine voted to establish a committee to study how physical medicine and psychiatry can be of optimum help to each other. It will be interesting to observe future developments in this direction.

5. Rennie, Thomas, A. C.: Relation of Psychiatry to Internal Medicine, Bull. Johns Hopkins Hospital 65:265 (Sept.) 1939.
6. Hall, Volta: Psychologic Implications of Physical Medicine, Occ. Ther. & Rehab. 28:21 (Feb.) 1949.
7. Watkins, A., and Finesinger, J.: Psychiatric Aspects of Physical Medicine, J. A. M. A. 135: 1050 (Dec. 20) 1947.
8. Menninger Foundation, "Guide to the Order Sheet," Topeka, Rev. 4, 1950.
9. Meislin, J.: "Psychiatric Aspects of Physical Medicine: Therapist-Patient Relationship." Paper read at the annual meeting of the American Congress of Physical Medicine at Denver, Sept., 1951.
10. Cannon, W. B.: "Bodily Changes in Pain, Hunger, Fear and Rage." Appleton & Co., 1915, N. Y.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Launch Special Study of Chronic Disease

A special study of chronic disease prevalence is being held to discover how many people in the United States are chronically ill and what facilities and services they need, the "Chronic Illness News Letter," reports.

One grant for $60,000 has been made by the Commonwealth Fund to the Hunterdon, N. J., County Medical Center to study the incidence of disabling chronic illness in the rural population.

Another, a preliminary grant for $10,000, has been made by the U. S. Public Health Service to assist the Commission in planning a similar survey in an urban population.

Prevalence of illness by disease will be measured and the study will seek information on different types of care needed; hospital, home care, rehabilitation, and other community services.

Pilot Program to Integrate Treatment of Emotional and Physical Ills

The first large scale demonstration of the benefits of integrating psychiatric treatment with already established rehabilitation techniques aimed at retraining the physically disabled will be made at the Institute of Physical Medicine and Rehabilitation, a unit of the New York University-Bellevue Medical Center.

Establishment of the new demonstration program has been made possible by a grant of $73,500 to New York University College of Medicine from the Commonwealth Fund, it was announced today (Wednesday, October 3), by Dr. Currier McEwen, dean of the College.

The new demonstration program, to be carried out over a three-year period, will be integrated with the present Psycho-Social-Vocational Service of the Institute of Physical Medicine and Rehabilitation, it was announced by Dr. Howard A. Rusk, the Institute's director.

In a joint statement, Dr. Rusk and Dr. S. Bernard Wortis, chairman of the College's Department of Psychiatry, stated that the primary aim of the new project will be to provide complete emotional and physical care for the disabled. At the same time, they stated, methods of using psychiatry and psycho-social techniques in treating the disabled will be included in the training of physicians and other members of the rehabilitation team.

The effect of this teaching phase of the program is expected to have widespread significance, since not only physicians but nurses, therapists, social workers, psychologists, vocational counsellors and other technicians train each year at the Institute, coming from the 48 states and many foreign countries.

Drs. Rusk and Wortis said that the findings of a recently concluded three-year psychiatric research project at the Institute had emphasized the need for integrating both emotional and physical problems in attempting to return the physically disabled to normal living. This concluded project, an investigation of the emotional problems of the physically handicapped, was also financed by the Commonwealth Fund.

New Jersey Society Meeting

The New Jersey Society of Physical Medicine met at 8:30 P. M. on October 17, at the N. J. State Medical Building, 315 West State Street, Trenton. The secretary of the New Jersey Society has written that it was a business meeting and several matters of importance were discussed.

Convention of Military Surgeons

At the 58th Annual Convention of the Association of Military Surgeons held recently at the Palmer House, Chicago, a scientific exhibit entitled "Total Rehabilitation in Myocardial Infarction," was presented. Dr. Louis B. Newman acted as moderator of a panel given as part of the program of the Women's Medical Specialists Corps.

Chicago Society of Physical Medicine and Rehabilitation

The October meeting of the society was held on Wednesday, October 24 at the Chicago Clinic of Physical Medicine. Dr. Milton G. Schmitt, Secretary-Treasurer, was host and principal speaker. "Physical Aspects of Backache," was the topic of the scientific session.

The next meeting will be held on Wednesday, November 28. Dinner will be at 6:30 P. M. at the Y. M. C. A., Medical Center, 1804 W. Congress St. The scientific session will be held at 8:00 P. M., Loyola University and the topic, "Treatment of Cerebral Palsy," will be presented. Dr. Joseph Koczur will act as host and principal speaker for the evening.

Accepted Devices

Electresteem Vaporizers. — Manufactured by Electric Steam Radiator Corporation, 1 Electric Ave., Paris, Kentucky, Models 10-24 Standard and DeLuxe are for humidifying rooms by heating water and discharging vapor. The Council on Physical Medicine and Rehabilitation voted to include both models of the Electresteem Vaporizer in its list of accepted devices.

Peerless High Frequency Epilation Unit No. 108. — Manufactured by Peerless X-Ray Laboratories and Manufacturing Corporation, 467 Tenth Avenue, New York 18, N. Y., device is intended for use in the removal of superfluous hairs. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Colostom-Ease Irrigator and Protector Belts. — Manufactured by the Colostom-Ease Corporation, 16 Marquette Dr., Pittsburgh 29, Pa., devices are designed to facilitate care of patients with colostomies. The Council on Physical Medicine and Rehabilitation voted to include the belts in its accepted list.

E & J Resuscinette. — Manufactured by E & J Manufacturing Company, 6116 San Fernando Rd., Glendale 1, Calif., apparatus is to be used for resuscitating newborn infants. The Council on Physical Medicine and Rehabilitation voted to include the device in its accepted list.

Prim Comforter.—Manufactured by Prim Fabrics Company, 905 N. Lawrence St., Philadelphia 23, Pa., apparatus is a bed covering for use of patients allergic to cotton, wool or down. It is filled with Fiberglas. The Council on Physical Medicine and Rehabilitation voted to include the Prim Comforter in its list of accepted devices.

Burdick Electrocardiograph Model EK-2. — Manufactured by The Burdick Corporation, 635 Plumb Street, Milton, Wis., model is a direct-writing instrument which records by means of an electrically heated stylus tracing on heat-sensitive paper. It is designed primarily for alternating current and is small enough to be carried about easily. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

The Birtcher "Personally Certified" Electrosurgical Unit Model 2000. — Manufactured by The Birtcher Corporation, 5087 Huntington Drive, Los Angeles 32, California; this device is a generator of high frequency currents for use in major and minor surgery. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Instruction in Radioactive Isotopes

The Naval Medical School at Bethesda, Md., is beginning a six-day course of instruction in the medical aspects of special weapons and radioactive isotopes on Nov. 26, 1951. The course is given primarily for inactive medical department officers of the Naval Reserve. For additional information, write to the school.

Personals

Dr. **Arthur S. Abramson,** White Plains, N. Y., recently received the First Annual National Rehabilitation Award of the National Service Council of the AMVETS. Dr. Abramson was recently appointed Assistant Clinical Professor of Physical Medicine at New York University College of Medicine, Consultant to the Kessler Institute for Rehabilitation and Consultant to the Muscular Dystrophy Associations of America.

At the recent scientific assembly of the New York State Academy of General Practice held in New York, Dr. **Edward W. Lowman** presented the topic "Rehabilitating the Arthritic."

Dr. **Ray G. Piaskoski** of Milwaukee has recently been named head of the new Department of Physical Medicine and Rehabilitation at Marquette University School of Medicine. He will organize the program at the university and a residency program at the VA Hospital at Wood, Wisconsin, where he is Chief.

At a meeting of the Cleveland Society of Physical Medicine and Rehabilitation, Cleveland Clinic, October 18, Dr. **H. T. Zankel** read a paper entitled, "The Saphenous Circulation Time Test Using Radioactive Iodine."

Dr. **Murray B. Ferderber** of Pittsburgh, Pa., will be one of the speakers at the special session on "Aging Challenges Public Health," given as part of the annual meeting of the American Public Health Association in San Francisco, Oct. 29-Nov. 2.

Pennsylvania Academy Meets

The first fall meeting of Pennsylvania Academy of Physical Medicine - Rehabilitation was held Thursday, October 18th, 1951, at the Philadelphia County Medical Society building. The newly elected president, Dr. Herman L. Rudolph, of Reading, Pa., presided. Others elected for the coming year are Dr. Frank L. Follweiler, Philadelphia, Vice-President; Dr. J. Murl Johnston, Pittsburgh, Treasurer; and Dr. Charles A. Furey, Philadelphia, Secretary.

The medical program included a paper by Dr. Bernard Judovich, entitled "Regional Therapy in Painful Syndromes." This was followed by a "Resume of Outstanding Papers at the Denver Meeting," presented by Dr. George Morris Piersol and Dr. Emery K. Stoner.

Conference at Hines VA

A conference on Cooperative Relationships in Hospital and Post-hospital Rehabilitation of Veterans will be held at the VA Hospital, Hines, Illinois, on Friday, November 2, 1951, from 9:00 A. M. to 4:00 P. M. Write to Dr. Louis B. Newman, Chief, Physical Medicine and Rehabilitation Service for additional details.

Newly Registered Therapists

October 15, 1951

Abdon, Roy E., 1103 E. 33rd St., Marion, Ind.
Akerly, Edward C., 1063 Harvard St., Rochester 10, N. Y.
Aldubi, Lemel D., 4 Shulamith St., Tel-Aviv, Israel.
Andrews, George, 80-44 164th St., Jamaica, L. I., N. Y.
Angell, Olin S., 53 W. Main St., Sidney, N. Y.
Anzideo, Ida L., 520 Crescent St., Jamestown, N. Y.
Bennett, Mary L., Thiells Rd., Stony Point, N. Y.
Bloch, Rudolph L., 29 Woodmere Blvd., Woodmere, L. I., N. Y.
Block, Edward, 7170 Delmar Blvd., St. Louis 5, Mo.
Brox, Eleanor B., 135 Baker Ave., Syracuse, N. Y.
Case, Robert, R. R. No. 3, % Lutz, Peru, Ind.
Casto, Richard L., 1103 Early St., Charleston, W. Va.
Cervera, Garcia, 1384 Franklin Ave., Bronx 56, N. Y.
Christensen, Robert H., P. O. Box 367, Kevin, Mont.
Connolly, Frank J., 2760 Bainbridge Ave., New York 58, N. Y.
Cotovsky, Louis, 1610 S. St. Louis, Chicago 23, Ill.
Cox, James M., 86 North St., Lexington, Mass.
Curry, Frank V., 1504 Villa Ave., Sioux City, Ia.
Desy, Henry C., 4010 Clark St., Kansas City, Mo.
DiRe, Henry L., 618 W. Fourth St., Anaconda, Mont.
Dykstra, Simon, 551 E. 24th St., Holland, Mich.
Fairbanks, Albert K., 426 Allen St., New Britain, Conn.
Freeburg, Richard E., 633 Greeves St., Kane, Pa.
Funkey, Gertrude L., 55 Kerry Rd., Parkview, Johannesburg, South Africa.
Gadd, Patricia M., 2209 Alger Rd., Lakewood 7, Ohio.
Galloway, John D., 504 Johnson Ave., Ridley Park, Pa.
Goscin, Alice M., 3302 Stickney Ave., Toledo 8, Ohio.
Hanbidge, Beryl M., Kerrobert, Saskatchewan, Canada.
Hirsch, Gertrude, 11-07 73rd Rd., Forest Hills, N. Y.
Hofmann, Ernst, 311 W. 69th St., New York 23, N. Y.
Hunt, Ruth N., 313 Jay, Olean, N. Y.
Huss, William P., 1520 S. 5th St., Milwaukee 4, Wis.
Keil, June M., Box 265, R. D. No. 1, Sewickley, Pa.
Klatzkin, Leonard, 2948 Brighton 4 St., Brooklyn 35, N. Y.
Laue, Helen L., 9721 N. Lake Dr., Milwaukee, 11, Wis.
Levy, Martin B., 307 S. Hewlett Ave., Merrick, L. I., N. Y.
Lewis, Priscilla J., 49½ S. Central St., Bradford, Mass.
Luby, Miriam F., 17 Grove St., New York 14, N. Y.
Marin, Virginia, 336 Park Ave., Rutherford, N. J.
Marshall, Ellen L., 134a Eutaw Ave., East Lynn, Mass.
Mesmer, Eunice J., R. R. No. 1, Ft. Atkinson, Wis.
Miller, Gerald C., 700 Rand St., Chippewa Falls, Wis.
Murko, Frederick R., 1040 La Salle St., Berwick, Pa.
Needham, Shirley F., R. F. D. No. 3, Brattleboro, Vt.
Nelson, Robert W., 311 N. Chester, Sparta, Wis.
Olson, Ann L., Rt. No. 2, Madison, Wis.
Papastratigakis, Peter, 630 W. 170th St., New York, N. Y.
Petuskey, William G., 619 Green St., Elizabeth, N. J.
Pollack, Albert R., 9801 Parkview Ave., Cleveland, Ohio.
Rickert, George A., 307 La Forte Ave., Syracuse 4, N. Y.
Rohan, Mary J., 1628 N. 53rd St., Milwaukee 8, Wis.
Rosenblatt, Stanley, 1837 Crotona Ave., New York 57, N. Y.
Ross, George J., 33 Main St., Tariffville, Conn.
Rossi, Joseph, 142 High Service Ave., North Providence, R. I.
Schendler, Evelyn J., 4106 Francis St., Kansas City, Kans.
Schmidt, Eleanor J., 520 Ashland Ave., Park Ridge, Ill.
South, Ruth A., 436 E. Whitman, Pocatello, Idaho.
Stein, Lloyd R., 91 Weberfield Ave., Freeport, L. I., N. Y.
Strobino, Otto P., 226 Trenton Ave., Paterson, N. J.
Tandyrak, Aleks, 821 Bergen Ave., Jersey City 6, N. J.
Vogl, Janet E., 613 Geneva St., Lake Geneva, Wis.
Weaver, James B., 110-37 84th Ave., Richmond Hill 18, N. Y.
Weiss, Gerald, 205 W. 10th St., New York 14, N. Y.
Weiss, Herman, 23 Hobson St., Newark 8, N. J.
Wolfe, Russell D., 1102 Ellis St., Waukesha, Wis.
Wolfgram, Julane D., 318½ Congress St., Oshkosh, Wis.
Zehner, Robert C., 8705 78th St., Woodhaven 21, N. Y.
Zielke, Lyle E., 712 S. Lincoln St., Shawano, Wis.
Zimmerman, James P., Rt. No. 4, Frederick, Md.
Zimmerman, Jean K., 819 Vine St., Wisconsin Dells, Wis.

BOOK REVIEWS

KURZWELLENTHERAPIE: DIE MEDIZINISCHE ANWENDUNG ELEKTRISCHER HOCHSTFREQUENZEN. By *Dr. Erwin Schliephake*, Professor of Internal Medicine in Wurzburg, with co-workers of *Prof. Dr. C. H. Sattler* (Eye Diseases), and *Dr. A. Kohaut* (Physical Formulas). Fourth edition. Cotlh. Price, $3.00. Pp. 214, with 167 illustrations and 2 tablets in text. Piscator-Verlag, Stuttgart, 1950.

It has been said: "Of books there are many, but few become transfigured into classical stature until they arouse a sense of universality despite the handicaps of language or the barrier of national chauvinism." Schliephake's text has for two decades ranked as a work of solid scholarship because it has contributed significantly and magnificently to our knowledge of short wave medical practice. His contribution is that of a pioneer who writes with an authority born of long intimacy with its complex ideology and deep understanding of the subject. Behind a balanced exposition free from redundancy and commendable for brevity, one finds a mass of important data both documentary and original subjected to critical evaluation by one who is distinguished for so many priorities as to make his name synonymous with short wave therapy. Virtually every chapter is replete with and representative of the most advanced opinions concerning the nature and action of short waves. Despite the blight of the war years and destruction of valuable data from his burned down home, the author was fortunate in partly recovering or duplicating missing information, which as added to the revised fourth edition continues to make this work the most authoritative text of foreign extraction. Short wave is thus not only evaluated from its relationship to physical, physiologic and clinical phenomena, but also from its chemical, organic, macro- and microscopic influence. It also introduces a provocative chapter of his recent studies related to the diagnostic possibilities found in short wave radiation and this by demonstrable and objective proof of its increasing importance in applied medicine. There is little to criticize in the face of the rich, generous, and original data contributed in this highly authoritative text except parenthetically to comment at his utter brevity on many original contributions stemming from other geographic and lingual centers than his homeland. Not to have recognized the voluminous writing and given generous credit to Lakhovsky for his discovery of short wave, which antedated his own pioneer contributions is an error which has disturbed the sense of equity of a large number of international students of this discipline. It is specious to devote about a single sentence to this French scientist for a contribution of singular importance to medicine and even less to many unmentioned American co-workers who the least that can be said also played a distinguished pioneer role in the orientation of Anglo-American medicine. The above remarks are not the views of a carping critic but a constructive criticism in order to help round out a work of such promising stature as to make it the classical example in its field. The publishers have also added their unstinted cooperation by presenting a format of many sided artistic beauty and constitutes a pleasing example of the printer's art.

PERSONAL HEALTH AND COMMUNITY HYGIENE. By *Harold S. Diehl*, M.A., M.D., Sc.D., Professor of Preventive Medicine and Public Health, and Dean of the Medical Sciences, University of Minnesota; Director, Health Studies, American Youth Commission; Former Member, National Advisory Health Council, United States Public Health Service; Member, Governing Council, American Public Health Association; Former President, American Student Health Association, and *Ruth E. Boynton*, M.S., M.D., Professor of Preventive Medicine and Public Health, and Director of the Students' Health Service, University of Minnesota; Former President, American Student Health Association; Member, Governing Council, American Public Health Association; President, Minnesota State Board of Health. Cloth. Price, $4.50. Pp. 469. McGraw-Hill Book Company, Inc., New York, 1951.

This book is a revision of a former work entitled "Healthful Living for Nurses," and it covers the subject of individual and community hygiene in 29 well-planned and extremely well-written chapters. It should be accessible in libraries everywhere, for it is difficult to imagine any English-reading person over the age of ten years who could not profit by going through this book. The stores and stands are full of literature on hygiene, some of it the work of authors obviously prejudiced, incompetent, or even unscrupulous; a book like this one, painstakingly factual and balanced, deserves all possible encouragement.

It has a few weak places, which may be mentioned because they are also to be found in other current books and can so easily be strengthened in future editions. On page 140 no mention is made of ill-placed lighting, ill-fitting shoes and garments, and ill-designed furniture as causes of bad posture. It is useless to tell people how to walk, stand, or sit when shoes are wrong, clothing irrational, chairs uncomfortable, desks and tables too high or too low, and lights so placed that one has to hold his head aslant to see his work. Correcting the environment automatically encourages

good posture and gait. On page 266 attention should be called to the recent work by Gaul and Underwood and by Jordon emphasizing the importance of the function of the feet as surfaces for the radiation of heat and evaporation of water, the evil consequences of hindering these functions by air-tight foot-wear, and the frequency with which dermatitis from chemicals in the shoes has been mistakenly diagnosed as fungus infection. The paragraph on the relation of cirrhosis of the liver to the consumption of alcohol (page 125) resorts to the evasive verb "may" and is generally weak. Teachers have been showing pupils pictures of hobnailed livers since 1905 without adequate factual basis and without demonstrable results, and it is time this aspect of the subject was dropped. On page 151 the word "refract" should be replaced by "reflect." On page 267 the word "tiptoe" is ambiguous, and the recommendations should include the discarding of shoes whenever one has sufficient privacy.

The chapters on sex life and modern parenthood are to be recommended as among the very best discussions of the subject, as to clarity, breadth of viewpoint, and objectiveness of attitude, to be found in current literature. It is to be hoped that this book will be widely read, not only by nurses, but also by the general public.

THE 1950 YEAR BOOK OF PHYSICAL MEDICINE AND REHABILITATION (December 1949 - January 1951). Edited by *Frank H. Krusen, M.D.*, Professor of Physical Medicine, Mayo Foundation; Head of the Section on Physical Medicine and Rehabilitation, Mayo Clinic. Associate Editors, *Earl C. Elkins*, Assistant Professor of Physical Medicine, Mayo Foundation; Consultant in Physical Medicine and Rehabilitation, Mayo Clinic; *George G. Deaver*, M.D., Professor of Clinical Rehabilitation and Physical Medicine, New York University College of Medicine; Director of the Department of Physical Medicine and Rehabilitation, Bellevue Hospital. Fabrikoid. Price, $5.00. Pp. 328, with 134 illustrations. The Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, Illinois.

The Year Book of Physical Medicine and Rehabilitation should be welcomed by all those physicians who are interested in this rapidly growing new specialty.

There is an opening chapter on the pertinent developments in this specialty during 1950 and a special article on the educational facilities in physical medicine and rehabilitation. Team work by Deaver is an excellent evaluation of the problem of rehabilitation of the handicapped.

The editors of this valuable and useful book have done an excellent job in not only selecting but in classifying the abstracts so that references to any specific work can readily be located. The value of the abstract has apparently determined the amount of space allotted to it, and the reader realizes the essence of the author's presentation has not been overlooked and wherever essential the abstract is well illustrated. There is an adequate index both as to subject matter and author. This book should be in the library of every physiatrist and physical therapist for ready and frequent reference.

RESEARCH IN MEDICAL SCIENCE. Edited by *David E. Green, Ph.D.*, and *W. Eugene Knox*, M.D. Cloth. Price, $6.50 . Pp. 492. The Macmillan Company, New York, 1950.

In this book, representatives of some 26 different fields of medical research survey the methods and problems that are of special interest at this time. The result is something that would have been difficult indeed for a single author to achieve, for the individual chapters are written not only with an intimacy of knowledge and distinctiveness of viewpoint, but also with an assurance and incisiveness that only the specialist can supply. A gratifying example is the chapter on anthropology which straightens out the popular confusion between constitution and body-types and uncompromisingly states the need for improved methods of anthropometry. Other chapters sketch the status of virus research, immunochemistry, enzyme chemistry, chemotherapy, vitamin research, psychiatry, and similar fields. Of more practical interest to the physician are the sections on endocrinology in cancer research, hypertension, rheumatic fever, and pediatrics. Each section includes valuable references, but there is unfortunately no index. The book will interest many readers, both those who are and those who are not themselves engaged in research. It will be especially inspiring, however, to medical students fortunate enough to have opportunities for original investigative work.

A TEXTBOOK OF THE PRACTICE OF MEDICINE. By Various Authors. Edited by *Frederick W. Price*, F.R.S. Ed., M.D., C.M. Ed., F.R.C.P., Lond., Hon. M.D. Belf., Consulting Physician to the Royal Northern Hospital and to the National Hospital for Diseases of the Heart, London; Formerly Physician and Honorary Pathologist to the Mount Vernon Hospital for Consumption and Diseases of the Chest, and Examiner in Medicine at the University of St. Andrews. Eighth Edition. Cloth. Price, $9.00. Pp. 2076. Oxford University Press, 114 Fifth Avenue, New York 11, 1950.

This is the eighth edition by Oxford University Press. It contains 2076 pages of basic medical science contributed by 31 outstanding authors from England.

The contents are divided into twenty sections, each section covering a group of diseases from the standpoint of causal agents or anatomic systems. The sections are subdivided into headings that deal with the respective subject matter in detail from the standpoint of diagnosis, prognosis and treatment.

This new edition includes additional articles of

importance such as: Injuries from Nuclear Fission, The Surgical Treatment of Congenital Heart Disease, Rehabilitation of the Paraplegic, Antibiotics and many others. The chapter on antibiotics is limited to discussions on penicillin and streptomycin. The old chapters have been rewritten with additional new material included.

There are 87 illustrations, most of which are diagrams and electrocardiographic recordings.

This text is a useful adjunct to the library of the medical student and general practitioner.

HUMAN PHYSIOLOGY. By *Bernardo A. Houssay*, M.D., Professor of Physiology, Director of the Institute of Biology and Experimental Medicine, Buenos Aires, Argentina; *Juan T. Lewis*, M.D., Professor of Physiology, Director of the Institute for Medical Research, Rosario, Argentina; *Oscar Orias*, M.D., Professor of Physiology, Director of the Mercedes and Martin Fereya Institute for Medical Research, Cordoba, Argentina; *Eduardo Braun Menendez*, M.D., Professor of Physiology, Member of the Institute of Biology and Experimental Medicine, Buenos Aires, Argentina; *Enrique Hug*, M.D., Professor of Pharmacology of the School of Medicine, Rosario, Argentina; *Virgilio G. Foglia*, M.D. Professor of Physiology, Member of the Institute of Biology and Experimental Medicine, Buenos Aires, Argentina, and *Luis F. Leloir*, M.D., Director of the Institute for Biochemical Research, Campomar Foundation, Buenos Aires, Argentina. Translated by *Juan T. Lewis*, M.D., and *Olive T. Lewis*. Foreword by *Herbert M. Evans*, M.D. First Edition. Cloth. Price, $14.00. Pp. 1118 with 499 illustrations. New York, Toronto, London: McGraw-Hill Book Company, Inc., 1951.

The McGraw-Hill Book Company is to be congratulated for publishing this outstanding volume of Physiology. This excellent textbook of Physiology is the product of seven eminent scientists from Argentina, five of whom are professors of physiology, one a professor of pharmacology, and one a director for biochemical research. The direction of this unusual group was under the able leadership of one of the world's best known physiologists, namely, Doctor Bernardo A. Houssay who was awarded the Nobel Prize for Medicine in 1947 for his work on the hormone produced by the pituitary gland. The writers have studied thoroughly the literature in mammalian physiology throughout the world and have therefore produced a well balanced account. The group effort — for it is just that — has conferred upon this treatise a remarkable unity, a unity otherwise given a treatise only by a single individual, and it is no longer possible for an individual to cover the whole field of such a broad and growing science as physiology.

The book has been written for medical students and for physicians who want to study the fundamental principles of physiology. Physiological discoveries sooner or later, states the author, always find useful applications in medicine and in hygiene but they must first become familiar to the medical man.

A book cannot be a substitute for intense, practical, and individual teaching; it can be no more than a useful guide. It is not easy to choose wisely and to present adequate knowledge in a field that is constantly developing over an ever wider area, extending to several allied sciences, and in which information must be kept up to date. The almost superhuman task has been admirably accomplished by this splendid group. The text is written in smooth and excellent English. The presentation of each subject is in logical sequence and illustrations for clarification are numerous and quite adequate.

In the pages preceeding the table of contents is a number of definitions for the standard units such as mass, length, force, acceleration and so forth. There is also a useful table of abbreviations and symbols for standard units. These will be found to be most useful to the medical student.

The text is divided into nine distinct sections but as Houssay so carefully points out, it is only for didactic reasons. This separation is completely artificial, as the whole organism is an indivisible anatomical and functional unit. The preface of a book is so often skipped over by many students but the preface by Houssay is worthy of a thorough study. It is full of wisdom and shows the measure of the man. Part one is given to "The internal environment and the blood"; part two discusses "The circulation"; part three, "Respiration"; part four, "Digestion"; part five, "Metabolism and nutrition"; part six, "Internal secretions"; part seven, "Reproduction"; part eight, "The formation and excretion of urine"; and part nine, "The nervous system."

Physicians will find this a very valuable reference book especially the section on internal secretions. Marked advances are being made in the field of endocrinology and the contributions of Houssay have been of no mean order. The section on the nervous system will be of special interest to physiatrists. In this section there is an excellent chapter on the electrical phenomena in tissues and another on the physiologic properties of muscle. The chapter on the physiology of physical exercise under the section on metabolism and nutrition should also prove an interesting subject for the physiatrist. This textbook is most highly recommended not only as a textbook for medical students but also as an outstanding reference book for the average physician who wishes to keep abreast of the moving tide of medical progress.

PHYSICAL MEDICINE ABSTRACTS

Rheumatoid Arthritis — Diagnosis and New Concepts of Therapy. Harold N. Neu, and William J. Reedy.

Nebraska M. J. **36**:293 (Sept.) 1951.

Neu and Reedy conclude from their study of rheumatoid arthritis that, while the important agents, ACTH and cortisone, are here to stay, they are not without danger. Likewise they will not be a completely satisfactory addition to the weapons with which we combat rheumatoid arthritis until more effective methods of prolonged administration become available. They feel that before employing these agents it is important that an accurate differential diagnosis of the rheumatoid arthritis be made. They suggest further that the measures of proved value which have been employed in the past should be utilized. These are mental and physical rest, rest to the involved joints, the great tripod of physical therapy (heat, massage, exercise), occupational therapy, diet, control of pain with the simplest measures such as aspirin, the judicious employment of psychotherapy. Thus oftentimes excellent improvement will be secured without overburdening the patient with expensive medication, following the discontinuance of which he is most likely to have a relapse. The greatest usefulness of hormone therapy is to induce a remission during which the above physical measures may be fully instituted. These measures should be continued after hormone therapy has been withdrawn. It is hoped that the utilization of these agents in the hands of investigators will lead us to more fundamental concepts of the etiology of rheumatoid arthritis and other rheumatic disorders and thereby point the way toward ultimate effective management

---

Associated Movements Between Limb and Respiratory Muscles as a Sequel to Brachial Plexus Birth Injury. Peter K. Robinson.

Bull. Johns Hopkins Hosp. **80**:21 (July) 1951.

Simultaneous contraction of muscles which do not normally act together, although supplied by the same nerve, has long been observed to follow injury to that nerve. Such associated movements have been recorded following regeneration of the facial nerve by Gowers, of the oculomotor nerve by Bielschowsky, and Ford and Woodhall pointed out that such phenomena also may be seen after regeneration of other peripheral and autonomic nerves. Little study, however, has been made of the associated movements after recovery from spinal root and plexus damage. Electromyographic records of such related activity between limb muscles after brachial birth palsy have been made by Leveuf, et al. Likewise Sargent demonstrated action potentials, which were synchronous with respiration, in the biceps and forearm extensors in a patient eighteen years after birth injury. Clinical records of the frequency of this associated activity, however, do not appear to have been made. Therefore, all adults available through the files of a general hospital, who had had brachial plexus damage at birth, were examined for evidence of such movements. The eight unselected patients who had suffered brachial plexus birth palsy were examined at intervals of from nine to twenty-three years after injury. Associated movements between muscles of respiration and partially paralyzed limb muscles were found in six of them, as shown by contraction of the latter during deep inspiration. To demonstrate that such abnormal activity might occur as a result of damage either to the phrenic nerve or to the nerve supply to the accessory respiratory muscles, the effect of use of the limb muscles on those of respiration was studied. Fluoroscopy in five of the six cases demonstrated diaphragmatic contractions in three, when the elbow was flexed. In one case contraction of the limb muscles produced associated activity in one of the superficially placed accessory respiratory muscles. The explanation for these functional connections following injury is discussed and their probable frequency emphasized.

The Diagnosis and Treatment of Conditions of Exposure: Trench Foot, Immersion Foot and Frostbite. Joseph C. Edwards.

J. Missouri M. A. **48**:621 (Aug.) 1951.

Patients with trench foot are divided into groups from mild, grade I, to grade IV. The first principle in the treatment of trench foot is to have the patient rest in a cool place, keeping the body comfortable, warm and clean. The feet should be washed daily with soapy water at 70 F. and dried gently, and the surface of the feet may be cooled with air currents from a fan or by exposing them to room temperature not exceeding 70 F. — preferably 60 degrees. This and absolute bed rest promote vasoconstriction and decrease local metabolic requirements. The body should be warm with enough blankets to make the patient comfortable. If the patients are seen immediately after damage, before swelling has occurred, warming in air or water at body temperature may be of value; after swelling is present, warming may do more harm than good. Some grade I mild, and grade I patients are permitted to walk to the latrine and to mess immediately. As soon as the acute pain has subsided, within a week in grade I and II, the patient is started on passive vascular exercises. He elevates

his feet at an angle of 45 degrees on a board or chair in his bed for two minutes, then rests them horizontally for five minutes, then sits with legs over the edge of the bed and dangles for two, and later three minutes, followed by resumption of the horizontal state. This is repeated three or four times daily during the next week or two while the patient is at bed rest. This, plus calisthenics in bed every morning, conducted by the ward master, helps keep these patients in good physical condition. Cool water soaks and whirlpool baths at 70 F. for from twenty to thirty minutes daily helped temporarily; whether or not they shorten the period of recovery was not established. Those with warm, swollen feet could not tolerate the cold water. Cooling the feet at bedtime would enable many patients to sleep without sedatives or analgesics. Some patients responded to applications of cold, even ice bags, with relief of pain.

Stiff Joints — Their Pathology and Treatment, with Special Reference to the Knee Joint. Leon Gillis.

Brit. J. Phys. Med. **14**:177 (Aug.) 1951.

The treatment of stiff joints can be considered from three aspects: (1) preventive; (2) active and nonoperative; and (3) operative. Preventive treatment depends entirely on the stage of the disease at which the surgeon is able to see the case. It is not always easy, or indeed possible, to prevent deformities from occurring. The stage at which active movements should begin depends upon the response of the patient to local and general rest. In the upper limbs, splints are always removed for meals and toilet, and when pain and swelling have subsided, graduated active exercises and physical therapy are prescribed. In the lower limbs the period of complete immobility can be prolonged, and muscle function should be maintained by contractions of the thigh and calf muscles. Quadriceps drill and faradism should invariably be a daily routine procedure. Remedial exercises when the symptoms are under control restore the damaged function. Weight and pulley exercises in bed help to restore the control of the muscles, so essential for movable joints. This is especially important in weight-bearing joints. A mobile joint with inadequate muscular control is particularly prone to injury, and such joints become the seat of a chronic effusion which may be more of a disability than a joint which is ankylosed in a good position. Physical therapy should be instituted immediately after the successful manipulation of a joint and the range of movement can be maintained and improved. In the case of finger joints, adhesions often are accompanied by traumatic arthritis, and forced movements during active stages of arthritis always fail. There can be no doubt that in the case of the elbow joint no forced movements ever should be applied; for the fingers, only active movements should be encouraged. The pathology, mechanism and causation of stiff joints, particularly the knee joint, are discussed in this article. Methods of preventing and treating such joints are detailed and a new operative procedure of knee arthroplasty by cap interposition is described.

New Developments in Industrial Surgery. Harry E. Mock, Jr.

Indust. Med. & Surg. **20**:385 (Sept.) 1951.

Early ambulation of surgical patients was slow in being accepted by the profession. It made the greatest gains during World War II although it had been used by some men for years before the war. As we look back now it is hard to understand why we were so hesitant to adopt it. We were thinking of an injured part or parts rather than the patient's body as a whole. By getting the patient up as soon after injury or surgery as possible, the body tissues do not have time to lose their tone, the long convalescence from bed rest alone is avoided, and the incidence of postoperative or post-traumatic complications is greatly diminished. If it is impossible to get the patient up, similar benefits can be derived from special exercises given in bed. A surgeon's responsibility is not over when the traumatic or operative wound is healed. His treatment must continue until the patient has made maximum improvement and can return to work. Physical and psychological rehabilitation are essential. There has been a gradually increasing recognition of this fact since World War I when physical therapy and occupational therapy were born. We all know the long road physical medicine has had to travel from the days of therapeutic lamps and diathermy machines in individual physicians' offices to our modern rehabilitation centers where patients are given massage and carefully supervised exercise and imbued with the desire to help themselves. Industrial surgery has been the leader in the field of rehabilitation. The greatest development in industrial surgery is the fact that today the majority of workmen are receiving all the advantages of the advancements in general surgery.

The Rehabilitation of the Hemiplegic. George G. Deaver.

Rhode Island M. J. **34**:421 (Aug.) 1951.

The hemiplegic patient, who has had a cerebral accident, as a result of embolism or thrombosis, usually can begin rehabilitation activities a few days after the accident. However, if the hemiplegia is caused by a hemorrhage, rehabilitation procedures should be limited to bed activities for three weeks. The purpose of a program of rehabilitation is to retrain the patient to walk and travel, care for his daily needs and to obtain the maximum use of the affected and unaffected arm, hand and speech. Disabilities which result from a cerebral accident are limitation of motion of the joints on the affected side and a spastic or flaccid paralysis. There may be a facial paralysis and if the paralysis occurs in the dominant arm, the patient usually will have a sensory and motor

aphasia. If treatment is started early there will be no limitation of motion at the joints and the affected arm and leg can be passively moved through their normal range. However, if the patient is not given early rehabilitation, contractures usually result, especially at the shoulder. If treatment is started within a few days following the cerebral accident there is no need for any special procedures to protect the affected limbs. If, however, due to hemorrhage in the brain or other complications, the patient must remain in bed for a period of time, then procedures must be instituted to prevent deformities. A posterior ankle splint is needed to prevent shortening of the heel cord. A pillow in the axilla will prevent adduction and internal rotation of the shoulder joint which is a frequent residual deformity in hemiplegia. Passive movements of the arm in abduction, external rotation and in the overhead position should be performed several times a day to prevent a "frozen shoulder." The principal deformities which occur are a "frozen shoulder" and short heel cord. In treating the "frozen shoulder," heat and massage to the arm and shoulder are of value in preparing the part for stretching. Passive movements of the shoulder are useful in increasing the range of motion. These movements can be performed by a therapist, nurse, or by the patient. A short heel cord seldom requires operative procedures. The heel cord usually can be lengthened with stretching and a short leg brace with a 90 degree to 110 degree stop at the ankle to hold the gains made by stretching and ambulation. A patient with flaccid hemiplegia from a cerebral accident will be unable to make a voluntary movement when in the supine position. However, if the patient is held in the erect position with the affected lower extremity on the floor, he will flex and extend the leg as in walking and be able to bear his body weight. The sensory contact of the foot on the floor stimulates the reflex pattern of walking. Ambulation should be the first procedure in the rehabilitation program, as it can be accomplished by the majority of patients. As a return of function in the affected upper extremity cannot be expected for a long period of time, if it ever does return, it is necessary to teach the patient to care for his daily needs with his unaffected arm. A right hemiplegia in a right-handed person is a serious disability because of the sensory and motor aphasia and the lack of skill in the left hand to perform the activities essential for daily living. The training of the left hand should be begun early as the patient must become left-handed if he ever hopes to care for his daily needs. Writing with the left hand is extremely important as a means of communication, especially if the speech is affected. The exercise program for retraining the affected arm depends upon the patient. Results cannot be expected by having a therapist work on the patient. Working with the patient so that he understands what exercises are to be practiced many times a day is the only procedure which will improve the disabled arm. The fingers of the spastic hemiplegic patient are practically impossible to reeducate for any useful purpose. If adequate function is attained, it will take years of effort by the patient. In the aged, with cardiovascular disease, it is not often worth the effort. However, we should not have the patient give up hope of ever using the fingers. He must be made to understand that movements of the fingers depend upon the proper functioning of the shoulder, elbow and hand and placing the hand in positions for purposeful movements.

A New Approach to the Treatment of Atrophied Muscles Resulting From Poliomyelitis: Preliminary Report. Meyer Shmugar.

Rocky Mountain M. J. **48**:519 (July) 1951.

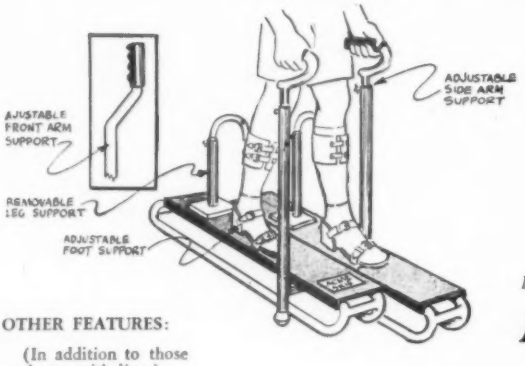
In 1947 the author started to use 0.25 per cent procaine in physiologic saline with riboflavin, thiamine chloride, and vitamin C for restoration of function in paralyzed muscles resulting from poliomyelitis. The majority of patients which he saw were chronic cases, ranging from three to nineteen years in duration. The drugs were given intra- and subcutaneously over the muscle areas involved. The results of the treatment have been promising. Atrophied and weakened muscles began to show signs of increased strength and, after varying lengths of time, increase in muscle size was noted. This report covers observations made for fifteen months on ten patients. The patients who came for this treatment had previously received the best known medical and surgical care in the acute and convalescent stages of the disease and were in an arrested stage of muscle atrophy or contracture. Many cases were receiving physical therapy at other sources when they first began this treatment. The entire procedure is based on the assumption that most paralyzed muscles resulting from poliomyelitis infection must contain some living muscle fibers even though our present method of muscle testing may not be able to detect it. The one objection in the course of these injections is the inconvenience to the patient due to the large number of needle pricks. The pain associated with this procedure is not as great as one would think since the procaine minimizes this feature. Experiments are carried out at present with iontophoresis as a method of replacing the multiple injections. This will be reported at a later date.

Correction:—For the title of the paper by Hirschberg and Abramson, September, 1951, issue, p. 575, read: "Studies on Spasticity: 1. — Effect of Neostigmine on Skeletal Muscles in Upper Motor Neuron Lesions." . . .

Correction:—Under "Other Officers Named for 1952," October, 1951, issue, p. 665, the note concerning **Dr. Frank H. Krusen** and the Financial Committee is erroneous. For it read: **Walter M. Solomon** is the new Chairman of the Finance Committee, with **H. W. Kendell** and **Charles Wise** serving as members of the Committee.

RECIPROCAL MOTION — ACME SKIS

FOR CHILDREN AND ADULTS



PURPOSE:

- Walking aid
- Balance Training
- Reciprocal motion of arms and legs in walking pattern

OTHER FEATURES:

(In addition to those shown with lines)

- Turning is possible
- Turning movement is eliminated if the side stop attachment is used
- The length of the steps can be regulated
- The leg supports are adjustable. May be turned aside if not needed or removed entirely

For Further Information Write:

ACME SKIS

Dept. 7
2805 S. Fairfax Ave.
Los Angeles 16, California

Pat. Pending

ACCEPTED
COUNCIL ON PHYSICAL MEDICINE and REHABILITATION
AMERICAN MEDICAL ASSOCIATION

- A.M.A. ACCEPTANCE
- F.C.C. TYPE APPROVAL D-500
- UNDERWRITERS' LABORATORIES APPROVAL
- CANADIAN TYPE APPROVAL Number 7

Choose Your Short Wave Diathermy Wisely

FISCHER De Luxe Model 400 offers . . .

Inductance Applications with the
PATENTED ADJUSTABLE INDUCTION ELECTRODE,
or inductance cable

Condenser Electrode Applications with
AIR SPACED ELECTRODES, pads and other designs

Minor Electrosurgery and any degree of Coagulation

FISCHER De Luxe Model 400 is the highly efficient, practically trouble-free, self-excited oscillator type—no crystal control or master oscillator.

Patented Adjustable Induction Electrode, designed especially to fit any part of the body, gives even distribution of heat over entire treatment area.

Write for FREE copy of Federal Communications Commission's questions and answers digest of regulations on operation of medical diathermy equipment.

H. G. FISCHER & CO. • Franklin Park, Illinois

A New Standard..

HANOVIA MEDICAL DIATHERMY

- Flexible in application
- New ease of operation
- Fingertip control
- Heavy duty performance
- FCC approved
- A.M.A. approved

Hanovia scientists and engineers have achieved new attainments in mechanical and electronic perfection in this new diathermy unit—a fact which has already reflected very favorably in the practice of short wave therapy.

The unit utilizes any of the approved types of applicators: air spaced, electro-induction cable, drums or special drum applicators, cuff electrodes and it is equipped for minor electro-surgery.

Request detailed literature NOW. Address Dept. 306-L.

HANOVIA *Chemical & Mfg. Company*
Newark 5, New Jersey

---

the
Vaso-Pneumatic
PAT. PEND.

TO
Actively and Directionally
MOVE FLUIDS IN THE EXTREMITIES

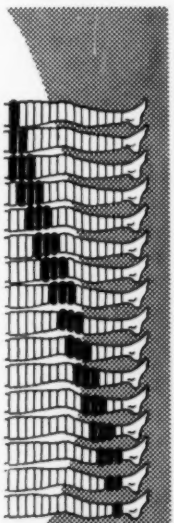
•

A series of quickly applied neoprene cuffs are automatically inflated and deflated to produce a band of pressure that progresses up or down the arm or leg with a peristaltic motion.

Usual treatment time 15 minutes.

Here is the complete cycle requiring just 2 seconds. Inflated cuffs shown in black.

Cycle repeats over and over at the rate of 20 times per minute. Direction may be reversed to travel toward the torso.



Send for complete information
POOR & LOGAN MFG. CO., 7319 Varna Ave., North Hollywood, Calif.

HYDROCOLLATOR

No Wringing
No Dripping

Steam PACK

30 Minutes Moist Heat With Each Application

Local MOIST HEAT can most effectively be applied with the HYDROCOLLATOR STEAM PACK. Simply heat in water, lift out, wrap in towel, and apply. Special silicate gel filler absorbs and holds water to give at least 30 minutes effective moist heat with each application. Packs can be used over and over. Intelligently designed to fit any body contour. Used in many leading hospitals and clinics.

Write for literature and prices.

Chattanooga Pharmacal Co., Inc.
Chattanooga 5, Tennessee

HYDROCOLLATOR MASTER UNITS

FOR THE HOSPITAL AND CLINIC

Model shown: 6-Pack Model SS

Maintains a constant supply of ready-to-use Hydrocollator Steam Packs. Several patients can be treated simultaneously. Handsome stainless steel construction. Fully automatic (thermostatically controlled).

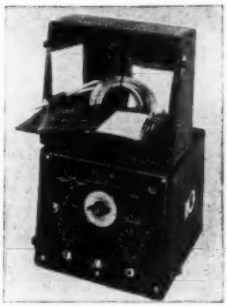
Write for literature, prices, user list.

Chattanooga Pharmacal Co., Inc.
Chattanooga 5, Tennessee

By
Patronizing
Our
Advertisers
You
Help
Support
Your
Journal

MEDCO • MEDCO • MEDCO • MEDCO •

In Rehabilitation Therapy



". . . a low volt current of unusual wave characteristics . . . with comparative freedom of discomfort. . . ."

Medcotronic MODEL 50
STIMULATOR

Write for descriptive literature.

MEDCO PRODUCTS CO. - TULSA 12, OKLA.
3503 E. Admiral Place

MEDCO • MEDCO • MEDCO •

No other medical periodical gives you such "wide coverage" in the field of physical medicine and rehabilitation as THE ARCHIVES

If you are a teacher of physical medicine, a research worker, a physicist, or just a clinician — if you want to stay abreast of all that is new in physical medicine and rehabilitation — you must read THE ARCHIVES.

Each month you will find in this journal informative articles, constructive editorials, physical medicine news, announcement of new books and a wealth of abstracted material dealing with every phase of physical medicine and rehabilitation.

If you are not a subscriber to THE ARCHIVES — send in your subscription today. Sample copy will be sent on request. Subscription price $7.00 per year; Canada, $8.00; elsewhere, $14.00 the year.

AMERICAN CONGRESS OF PHYSICAL MEDICINE,
30 No. Michigan Ave., Chicago 2.

Please find enclosed check for $7. ☐ or bill me ☐ for one year's subscription to the ARCHIVES.

Name.....

Address.....

City, Zone and State.....

DIRECTORY

of the

AMERICAN REGISTRY of PHYSICAL THERAPISTS

is available at a cost of $1.00

Address all communications to

AMERICAN REGISTRY OF PHYSICAL THERAPISTS
30 North Michigan Avenue Chicago 2, Illinois

PHYSICAL MEDICINE AND REHABILITATION **

The following services are approved by the Council and the American Board of Physical Medicine and Rehabilitation. Residencies in this specialty have been approved without specifying the number of years for which they are accredited. The Board will give appropriate credit for training in these hospitals on an individual basis.

Hospitals, 43 Assistant Residencies and Residencies, 87

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	First Year Residencies Offered*	Total Residencies Offered*	Beginning Stipend (Month)
UNITED STATES ARMY							
Letterman Army Hospital★	San Francisco	A. E. White	3,330	74,961	....	....	.....
Fitzsimons Army Hospital★	Denver	H. B. Luscombe	19,403	258,913	1	4	.....
Army Medical Center★	Washington, D. C.	J. H. Kuttert	6,755	263,456	3	5	.....
VETERANS ADMINISTRATION							
Veterans Admin. Hospital★[1]	Long Beach, Calif.	R. N. Nyquist	10,922	195,816	1	2	.....
†Veterans Admin. Hospital [1]	Fort Logan, Colo.	F. J. Fricke	907	36,326	....	....	.....
Veterans Admin. Hospital	Hines, Ill.	L. B. Newman	5,665	450,711	....	....	.....
Veterans Admin. Hospital [1]	Wadsworth, Kans.	L. Blau	3,169	192,760	....	....	.....
Veterans Admin. Hospital [1]	Framingham, Mass.	F. Friedland	7,000	210,000	1	3	.....
Veterans Admin. Hospital [1]	Jefferson Bks., Mo.	E. H. Weissenb'g	2,215	77,491	1	1	.....
Veterans Admin. Hospital [1]	New York City	A. S. Abramson	13,819	314,026	3	9	.....
Veterans Admin. Hospital [1]	Cleveland	H. T. Zankel	6,414	81,929	1	1	.....
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowlks	4,954	110,429	1	1	.....
†Veterans Admin. Hospital [1]	Aspinwall, Pa.	S. Machover	2,516	106,131	....	1	.....
Veterans Admin. Hospital★[1]	Houston, Tex.	B. L. Boynton	1,582	6,894	1	1	.....
NONFEDERAL							
Los Angeles County Hospital★[1]	Los Angeles	E. Austin	.....	91,836	....	1	165
White Memorial Hospital★	Los Angeles	F. B. Moor	195	.....	1	1	120
University of Colorado Medical Center Colorado General Hospital★[1]	Denver	H. L. Dinken	2,580	45,876	1	3	75
State of Connecticut Vet. Home & Hosp.	Rocky Hill, Conn.		.....	.....	3	3	.....
Emory University Hospital★	Emory Univ., Ga.	R. L. Bennett	1,719	10,473	1	1	50
Georgia Warm Springs Foundation	Warm Springs, Ga.	R. L. Bennett	973	104,401	1	3	250
Cook County Hospital★[1]	Chicago	D. Kobak	7,501	37,516	....	....	.....
Michael Reese Hospital★[1]	Chicago	C. O. Molander	2,254	19,589	1	1	25
Northwestern University Medical Center	Chicago		13,590	40,962	....	....	.....
Research and Educational Hospitals★[1]	Chicago	H. W. Kendell	5,688	11,769	1	3	55
University of Kansas Medical Center★[1]	Kansas City, Kans.	D. L. Rose	2,456	42,310	1	1	100
Massachusetts General Hospital★	Boston	A. L. Watkins	2,925	31,999	0	9	41.66
University Hospital★	Ann Arbor, Mich.		.....	.....	....	....	.....
University of Minnesota Hospital★[1]	Minneapolis	M. Knapp	20,409	29,436	4	4	.....
Mayo Foundation	Rochester, Minn.	F. H. Krusen	.....	.....	2	6	135
Barnes Hospital★	St. Louis	S. Mead	9,759	9,759	0	1	.....
†Bellevue Hosp., Div. III, N. Y. Univ.★[1]	New York City	H. A. Rusk	4,058	116,705	....	7	80
Goldwater Memorial Hospital★	New York City	M. Dacso	733	50,706	1	2	80
Hospital for Joint Diseases★	New York City	J. Weiss	.....	94,631	1	1	40
Hospital for Special Surgery	New York City	K. G. Hansson	20,806	40,810	1	1	160
Mount Sinai Hospital★[1]	New York City	W. Bierman	11,942	36,970	1	1	50
New York City Hospital★[1]	New York City	F. K. Safford, Jr.	1,138	41,088	1	1	130
†Presbyterian Hospital★[1]	New York City	W. B. Snow	35,865	103,546	1	1	208
St. Luke's Hospital★[1]	New York City	R. Muller	900	98,954	1	1	60
†Rehabilitation Hospital	W. Haverstraw, N. Y.	M. Hoberman	5,868	408,371	1	1	225
Cleveland Clinic Hospital [1]	Cleveland	S. G. Gamble	17,062	38,475	1	4	.....
Hospital of the University of Pa.★[1]	Philadelphia	G. M. Piersol	1,636	35,639	0	1	.....
Philadelphia General Hospital★[1]	Philadelphia	A. A. Martucci	2,827	23,733	1	1	75
Medical College of Virginia—Hosp. Div.★[1]	Richmond, Va.	W. J. Lee	4,575	40,327	....	....	46.50

The star (★) indicates hospital approved for intern training.
The dagger (†) indicates temporary approval.
[1] Residencies open to women.
** Reprinted in part J. A. M. A. 147:140 (September 29) 1951.

ARCHIVES AVAILABLE ON MICROFILM

The ARCHIVES OF PHYSICAL MEDICINE is now available to libraries in microfilm. A microfilm edition will be sold only to bona fide subscribers of the ARCHIVES, is not for resale and will be distributed at the end of the volume year.

For further information, inquiry should be directed to UNIVERSITY MICROFILMS, 313 North First Street, Ann Arbor, Mich.

APPROVED SCHOOLS OF OCCUPATIONAL THERAPY **

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Director and Medical Director	Entrance Requirements	Duration of Course[1]	Classes Begin	Graduates in 1950	Tuition per Year	Certificate, Diploma, Degree
University of Southern California, Los Angeles*	Margaret S. Rood	Degree	18 mos.	Varies	12	$594	Certificate
Mills College, Oakland, Calif.	J. B. Armstrong, M.D.	High sch.	5 yrs.	Varies	19	$540	Cert. & Deg.
San Jose State College, San Jose, Calif.*	Elsa H. Hill	Degree	2½ yrs.	FebSept	2	$250	Certificate
University of Illinois College of Medicine, Chicago*	S. M. Dorinson, M.D.	High sch.	5 yrs.	FebSept	4	$650	Cert. & Deg.
State University of Iowa, Iowa City*	Mary D. Booth	Degree	18 mos.	Varies	1	$ 28.50	Certificate
University of Kansas, Lawrence	Charles Ianne, M.D.	High sch.	45 mos.	Varies	13	$ 28.50	Cert. & Deg.
Boston School of Occupational Therapy, 7 Harcourt St., Boston*	Beatrice D. Wade	High sch.	5 yrs.	MarSept	13	$110	Degree
Wayne University, Detroit*	S. W. Olson, M.D.	.....	.....	.....	...	.....	.....
Kalamazoo School of Occupational Therapy, Kalamazoo, Mich.*	Marguerite McDonald	.....	19 mos.	FebSept	2	$144[2]	Certificate
Michigan State Normal College, Ypsilanti, Mich.*	W. D. Paul, M.D.	High sch.	46 mos.	FebSept	5	$144[2]	Cert. & Deg.
University of Minnesota, Minneapolis*	Nancie B. Greenman	High sch.	45 mos.	FebSept	16	$135[2]	Degree
College of St. Catherine, 2004 Randolph, St. Paul	D. L. Rose, M.D.	.....	.....	.....	...	.....	.....
Washington University School of Medicine, St. Louis*	Marjorie B. Greene	Degree	2 yrs.	Sept	13	$500	Diploma
University of New Hampshire, Durham*	A. W. Reggio, M.D.	High sch.	5 yrs.	Sept	21	$500	Degree
Columbia University College of Physicians and Surgeons, New York City*	Barbara Jewett	Degree	19 mos.	Varies	1	$150	Certificate
New York University School of Education, New York City*	F. A. Weiser, M.D.	High sch.	46 mos.	Varies	2	$150	Degree
Ohio State University, Columbus*	Marion R. Spear	Degree	18 mos.	FebSept	3	$ 75[2]	Diploma
Philadelphia School of Occupational Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia*	R. B. Burrell, M.D.	1 yr. coll.	4 yrs.	FebSept	23	$ 75[2]	Dipl. & Deg.
Texas State College for Women, Denton	Frances Herrick	High sch.	5 yrs.	FebSept	6	$ 67.50[2]	Cert. & Deg
Richmond Professional Institute, 901 W. Franklin St., Richmond, Va.*	V. L. VanDuzen, M.D.	.....	.....	.....	...	.....	.....
College of Puget Sound, 18th and Warner Sts., Tacoma, Wash.*	Borghild Hansen	High sch.	40 mos.	Sept	12	$126[2]	Degree
University of Wisconsin, Madison*	F. J. Kottke, M.D.	.....	.....	.....	...	.....	.....
Milwaukee-Downer College, Dept. of Occupational Therapy, 2512 E. Hartford Ave., Milwaukee	Sister Jeanne Marie	High sch.	4½ yrs.	Varies	24	$225	Degree
Mount Mary College, 92d and Burleigh, Milwaukee	J. M. Ryan, M.D.	.....	.....	.....	...	.....	.....
	Erna L. Rozmarynowski	Degree	11-14 mos.	Sept	...	Univer-	Certificate
	R. A. Moore, M.D.	2 yrs. coll.	28 mos.	Sept	14	sity	Degree
	Esther Drew	High sch.	5 yrs.	Sept	8	$200[2]	Cert. & Deg.
	I. A. MacDonald	.....	.....	.....	...	.....	.....
	Marjorie Fish	Degree	17 mos.	Sept	20	$600	Certificate
	W. B. Snow, M.D.	2 yrs. coll.	27 mos.	Sept	10	$600	Degree
	Frieda J. Behlen	1 yr. coll.	.....	FebSept	3	$500	Certificate
	John Sawhill, M.D.	High sch.	4½ yrs.	FebSept	26	$500	Cert. & Deg.
	Martha E. Jackson	High sch.	4 yrs.	Varies	15	$ 90[2]	Degree
	R. H. Jacques, M.D.	.....	.....	.....	...	.....	.....
	Helen S. Willard	Degree	18 mos.	Sept	21	$600	Certificate
	I. C. Yaskin, M.D.	High sch.	5 yrs.	Sept	1	$600	Degree
	Fanny B. Vanderkooi	Degree	18 mos.	FebSept	...	.....	Certificate
	O. T. Woods, M.D.	High sch.	5 yrs.	FebSept	5	$ 50	Degree
	H. Elizabeth Messick	High sch.	4 yrs.	Sept	5	$200	Degree
	I. E. Barrett, M.D.	Degree	10-18 mos.	FebSept	4	$182+	Certificate
	Edna-Ellen Bell	.....	2 yrs.	FebSept	...	$400	Certificate
	A. J. Hermann, M.D.	High sch.	5 yrs.	FebSept	5	$350	Cert. & Deg.
	Caroline G. Thompson	High sch.	5 yrs.	Sept	12	$120[2]	Cert. & Deg.
	H. D. Bouman, M.D.	.....	.....	.....	...	.....	.....
	Henrietta W. McNary	2 yrs. coll.	3 yrs.	Sept	2	$350	Diploma
	M. C. Borman, M.D.	High sch.	5 yrs.	Sept	20	$350	Dipl. & Deg.
	Sister Mary Arthur	High sch.	5 yrs.	Sept	14	$260	Cert. & Deg.
	J. C. Griffith, M.D.	.....	.....	.....	...	.....	.....

** Reprinted J. A. M. A. 146:198 (May 12) 1951.

1. Duration of course is expressed in academic years or in number of months.

2. Nonresidents charged additional fee.

* Male as well as female students admitted.

In that precious instant when newborn life hangs in the balance . . . the dependable E & J resuscitator can mean victory . . . and the first welcome cry of *life*.

The E & J machine adjusts itself to even the tiny lungs of premature infants, signals the operator when aspiration is required to remove mucus or other foreign matter, breathes for the baby until natural breathing is firmly established.

The equipment enables your hospital to take positive, effective action when there is acute danger of a newborn life slipping away forever. You may see a demonstration at no obligation...just write or phone any of the offices listed.

The Breath of Life

E & J MANUFACTURING CO.
Glendale 1, California

Sales, Service Centers: Philadelphia, Pittsburgh, Boston, New York, Chicago, Oakland, Seattle, Salt Lake, Detroit, San Antonio.

POSITION OPEN —

Chief Physical Therapist. Syracuse Memorial Hospital, 736 Irving Avenue, Syracuse 10, New York.

Chicago Society of Physical Medicine and Rehabilitation

Meeting

Wednesday, November 28, 1951

Loyola University Medical School
706 S. Wolcott Ave.

8:00 P. M.

Physicians, other professional personnel and their guests are welcome.

MEETINGS OF INTEREST TO THOSE IN THE FIELD OF PHYSICAL MEDICINE AND REHABILITATION

In this column will be published information about meetings of interest to those in the field of physical medicine. New data should be sent promptly to the office of the ARCHIVES, 30 North Michigan Avenue, Chicago 2, Illinois.

International

International Congress of Physical Medicine (1952). London, July 14 to 19, 1952. Applications for the provisional program should be addressed to the Honorary Secretary, Dr. A. C. Boyle, International Congress of Physical Medicine (1952) 45, Lincoln's Inn Fields, London, W.C. 2.

American Society of Physical Medicine and Rehabilitation
Officers and Committees for 1952

President — **Frances Baker**
President-Elect — **Walter McClellan**
Vice-President — **Donald L. Rose**
Secretary-Treasurer — **Max K. Newman**

Board of Governors

Miland E. Knapp
Frances Baker
Walter McClellan
Max K. Newman
Ben L. Boynton
Alvin B. C. Knudson
William D. Paul

Membership Committee

Harold Dinken
Herman Rudolph
Solomon Winokur

Nominating Committee

Nila Covalt
George Wilson
Louis B. Newman

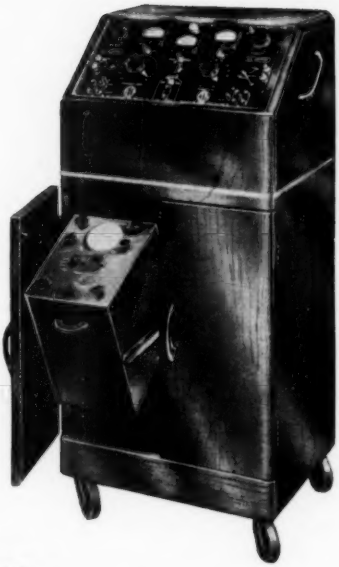
Program Committee

Joseph McRae
Donald Covalt
Murray Ferderber

TECA CD4

a low price generator with variable frequencies for conventional low-volt therapy

- Muscle Stimulation
- Ion-Transfer Therapy
- Electro Diagnosis
- Medical Galvanism



AVAILABLE CURRENTS:

A. C., from 18 to 3000 cycles per second in sine wave and square wave.
D. C., straight and any desired degree of pulsation.

ALL CURRENTS SURGING, from 6 to 60 surges per minute.

SUPERIMPOSED CURRENTS, any alternating current can be superimposed on any direct current, or vice versa.

OSCILLOSCOPE, optionally, CD4 may be equipped with a 3" oscilloscope.

TWO CIRCUITS, separate circuits and controls for A. C. and D. C. for easier operation and wider range of application.

For literature, price, demonstration, write Dept. 11AP.

TECA CORPORATION 220 WEST 42ND ST., NEW YORK 18, N. Y.

Simple To Operate
Reliable • Efficient

FISCHERTHERM

F. C. C. TYPE APPROVED NO. D-537
FOUR-TUBE CLINIC MODEL 1500

PRICE $375.00

DISTINCTIVE FEATURES:

PORTABILITY—Considering the high output of the Model 1500 FISCHERTHERM, its light weight of 62 pounds net is remarkable.

FREQUENCY CONTROL—The frequency is controlled at 27.120 MC. and requires no crystal oscillator amplifier, no buffer amplifiers, no doubler amplifiers and no neutralization adjustments. It is designed and engineered to operate continuously on heavy duty applications.

Also C. S. A. Approval No. 10616, Listed No. 53, Department of Transport, Canada, Telecommunications Division.

Manufacturer of ELECTRO-THERAPY EQUIPMENT

R. A. FISCHER & CO. 517 COMMERCIAL ST. GLENDALE 3, CALIF.

OPPORTUNITIES AVAILABLE

(Please send for our Analysis Form so we may prepare an individual survey for you)

WANTED — PHYSICAL THERAPISTS FOR FOLLOWING: (a) Qualified to serve as chief, new department directed by orthopedic surgeon; leading hospital; large city, university medical center; Midwest. (b) Long established clinic department handles mostly general, orthopedic and medical patients; large city, university medical center, West. (c) Department operated by one of country's leading private practice groups; new hospital under construction; interesting location; West; $3600-$4800.) (d) To join staff of curative workshop operated by state society for crippled children; should be interested in rehabilitation; university medical center; South. (e) To join staff of health department, public schools; college town of 40,000; Pacific Northwest. (f) General 350-bed hospital; preferably one interested in cerebral palsy cases; fairly large city; Ohio.

WANTED — PHYSIATRISTS — (a) Association with a group of orthopedic specialists; East. (b) Young physician trained in physical medicine or willing to be trained in that specialty; should be interested in rehabilitation. (c) Director new rehabilitation center; professionally sponsored; Southwest. For further information regarding these opportunities, please write Burneice Larson, Medical Bureau, Palmolive Building, Chicago.

QUALIFIED PHYSICAL THERAPIST for children's polio hospital. Excellent salary; Social Security. For information write: Mrs. H. A. Kniffin, Children's Country Home, Westfield, N. J.

CHANGE OF ADDRESS

Send your new address at least 30 days before the month of the issue with which it is to take effect. Address

THE ARCHIVES OF PHYSICAL MEDICINE
30 North Michigan Avenue, Chicago 2, Ill.

Send old address with the new, enclosing if possible your address label. The Post Office will not forward copies unless you provide extra postage. Duplicate copies cannot be sent.

THE KABAT-KAISER INSTITUTE

at Vallejo, California, announces three months post-graduate courses for physical therapists in technics of neuromuscular re-education. Physical therapists must be members of the American Physical Therapy Association, members of the American Registry of Physical Therapists or qualified foreign physical therapists. Courses start October 1st, January 1st, April 1st, and July 1st. Number of students accepted is limited. Certificate given upon successful completion of the course. Tuition: $150.

Applicants should communicate with:

Margaret Knott
Chief Physical Therapist
KABAT-KAISER INSTITUTE
VALLEJO, CALIFORNIA

Georgia Warm Springs Foundation GRADUATE COURSE

Physical Therapy and Occupational Therapy in the Care of Poliomyelitis

This course is open to graduates of approved schools in physical therapy and occupational therapy. Such graduates must be members of the American Physical Therapy Association and/or the American Registry of Physical Therapists and Occupational Therapy Association.

Tuition: None. For Scholarship to Cover Transportation and Maintenance, Contact National Foundation for Infantile Paralysis, 120 Broadway, New York 5, New York.

Entrance Dates: First Monday in January, April, July and October.

Duration of Course: The Course is divided into two parts:

Part I. Over-all care of convalescent polio with particular emphasis and special training in muscle testing and muscle reeducation.

Part II. Particular emphasis and special training in functional testing and functional retraining.

Each Part lasts three months and only selected students who have completed Part I will be admitted to Part II. All students applying for Part I must be willing to remain through Part II if selected.

For Information Write:

ROBERT L. BENNETT, M.D.
Georgia Warm Springs Foundation
WARM SPRINGS, GEORGIA

OFFICIAL INSIGNIA

THE AMERICAN REGISTRY OF PHYSICAL THERAPISTS

The PIN
(About Actual Size)

The official pin is made of 1/10 carat gold with purple enamel trim.

$5.40
(Including Federal Tax)

The EMBLEM
(Two-thirds Size)

Gold and purple on white cloth. Color fast. Each,

25c

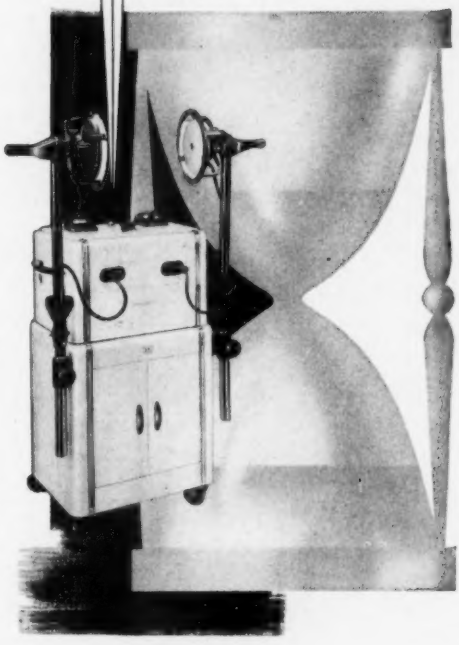
The pin or the emblem may be obtained with "S" or "J". Cost must accompany order. (Prices subject to change without notice.)

All Prices Subject to Change Without Notice.

Address all communications to
AMERICAN REGISTRY OF PHYSICAL THERAPISTS
30 N. Michigan Ave. Chicago 2

it's TIME to consider...

TIME-SAVING
LIEBEL-FLARSHEIM DIATHERMY



Yes, time is running out. F.C.C. restrictions on diathermy frequency and harmonics will be in full effect June 30, 1952.

The latest L-F short-wave diathermy — Model SW 660 — meets all F.C.C. requirements and *will pay for itself* in the time it saves in YOUR office.

And that's not all. The SW 660 is a powerful, safe, efficient and easy-to-use diathermy — the finest L-F diathermy in our thirty-five years of business.

We'll be glad to send complete information. Naturally, there's no obligation . . . and we'll include the new chart "Modern Medical Diathermy Technics" showing 22 typical treatment applications in *full* color. Fill out the coupon and mail it now!

THE LIEBEL·FLARSHEIM COMPANY

L-F

CINCINNATI 2, OHIO

Please send me at once and without obligation . . . information on the L-F SW 660 Diathermy unit.

NAME_____

ADDRESS_____

THE BIRTCHER CORPORATION

MANUFACTURERS OF MEDICAL & SURGICAL EQUIPMENT

C. J. BIRTCHER, PRESIDENT • 3257 HUNTINGTON DRIVE • LOS ANGELES 32, CALIF. • PHONE CAPITOL 1-5121

Dear Doctor:

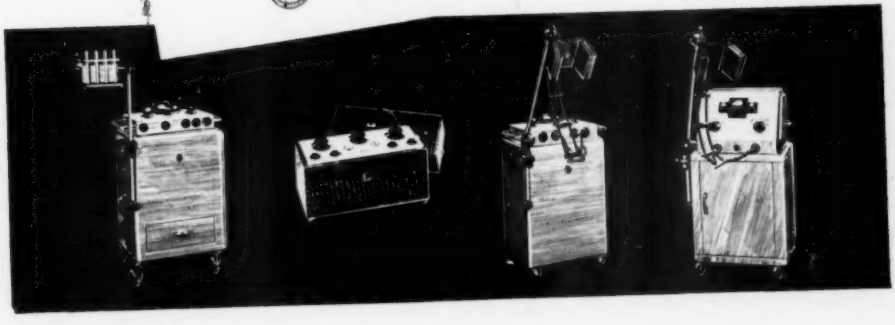
At the Denver meeting, I - a "peddler" - was honored to be included in such a distinguished and forthright group.

I was privileged to attend the reading of many papers and outside the meetings, I spent pleasant and instructive hours with various medical men.

I hope I may continue to provide the essential instruments for the "brains" of Physical Medicine.

Sincerely,

Cecil Birtcher

Cecil Birtcher
President
The Birtcher Corporation

CABLE ADDRESS "BIRTCOR" | ALL CODES